THE EARLY HISTORY OF THE ANNUITY

BY

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The present paper, dealing with the fascinating and compelling story of the annuity, is offered in line with the purpose of the Council and of the Educational Committees of the Society to have papers presented on the fundamental aspects of insurance. Students who follow the usual references in Section 8 of our syllabus are likely to consider chiefly the superficial mechanics of annuity computation, and to overlook some very important historic, legal, economic and underwriting aspects of this type of insurance. It will be possible to present the landmarks in the history of the annuity, bringing the record to that point in the nineteenth century when the transaction of annuity business passed almost entirely into the hands of insurance corporations. The real history of the annuity remains, however, to be written. Let us consider at the outset certain organic definitions.

Definitions

We have before us the definition given by Sir Edward Coke (born 1552; died 1633). During his incumbency as Lord Chief Justice of the King's Bench, 1613-1620, he defined an annuity as "a yearly payment of a certain sum of money granted to another in fee, for life or years, charging the person of the grantor only." There are scores of definitions by our American courts which hark back to the one given by Coke. In some of our American decisions, a definition is given which virtually includes the socalled "rent charge." In the case of Routt *v.* Newmann, (97 N. E. 208, 209; 253, Ill., 185), Coke's definition is given, and the following words are added: "or in a broader sense, a fixed sum payable periodically, chargeable on real property as well as on a person." The weight of the decisions available is that a clear distinction must be made between an annuity as defined by Coke, and a "rent charge," which is sometimes confused with an annuity. In the case of Lynch *v.* Houston (138 Mo. App. 167), there appears this definition: "a *rent charge* is a charge against land in the hands of the purchaser, and arises out of the land itself, while an

"annuity" is a yearly payment of a certain sum of money granted to one for life, years, or in fee, chargeable upon the person of the grantor." In this case, it was pointed out, however, that a deed of land in consideration of the payment to the grantor of an annual sum until the grantor's death, and retaining a lien to secure said payments, imposed merely a personal obligation to make the payments and created an annuity and not a land charge, the provision securing the payments by a lien not affecting the personal character of the obligation. The fact that the grantor rented the land, and applied the rent on the annual payments with the grantor's acquiescence, did not affect the character of the instrument. None of the American decisions available at this writing mentions specifically those pseudo-annuities which are chargeable against rights and personal property. These types of annuities were sold in the late Middle Ages and apparently have become obsolete.

Annuities and Other Periodical Incomes Distinguished

While the distinction between an annuity and a rent charge is clear, yet there has been much confusion because of the occasional crossing of the definitions. The annuity as defined by Coke, has sometimes been called a personal fee, because though strictly personal estate, it partakes of the general nature of real estate, being transmissible as an estate of inheritance, and not passing to the executor upon the death of the annuitant. Although the annuity contract has been consistently considered to be a personal contract, and so a technical *chose in action*, that is to say, a mere right to recover a debt or to redress a wrong by a suit at law, yet the rigorous document of the common law against the assignment of such choses in action, seems to have been relaxed at a very early date with respect to annuities, probably on account of their frequency, and because of the necessity for permitting free alienation.

A *writ of annuity* in the early common law was a writ to enforce the payment of an annuity. This has long since become obsolete in practice.

It may be well to mention some of the various types of income which have been confused with annuities. We have defined a "rent charge." It has been stated in the case of Brown's Estate,

143 Cal. 450, that a gift of an income from a certain fund is not an "annuity." It is not "income" or "profits," or indeterminate in amount, varying according to income or profit, though a certain sum may be provided out of which it is to be payable (Poe *v.* Raleigh and A. Air Line Co., 141 N. C. 525). Hence when a testator gives a beneficiary the interest upon a certain sum payable annually, it is not an annuity, but merely an ordinary legacy. The income or interest on a certain fund (bequest) is not an annuity but simply profit to be earned, and although directed to be paid annually, that relates only to the mode of payment and does not change the character of the bequest.

Common, Formal Types of Annuities

Limiting ourselves to Coke's definition, the various types of annuities may be divided into two main classes, *annuities certain* and *contingent annuities*.

The first, or *annuity certain*, is a series of payments made at equal intervals over a fixed period of years. All term annuities come under this classification. The whole class may be divided, according to time of first payment, into *immediate annuities* in which the first payment is made at the end of the first period; or *annuities due*, in which the first payment is made at the beginning of the first period; or *deferred annuities*, in which the first payment is made after a lapse of a given number of years.

These annuity payments may be made annually, semi-annually, quarterly, etc. The *continuous annuity* is one in which the payments are assumed to be made payable momently by infinitely small installments. This form is purely theoretical, but one which is approximated by the income of firms receiving many small accounts daily. When payments are to continue forever, the transactions are called *perpetual annuities* or *perpetuities*. While the payments of most annuities are constant in size, they may vary in an ordered fashion either increasing or decreasing by arithmetical or geometrical progression. In some few cases, the successive payments from a series in which the rth term is a rational intregal function of "r". When the successive payments of an *annuity certain* are not taken as they fall due, but are left to accumulate at compound interest, the annuity is said to be *forborne*.

The second, or *contingent annuity*, is one for which the date either of the first or the last payment depends upon some event, the time of whose occurrence can not be foretold. Thus annuities whose payments begin or end with the death of an individual are contingent annuities. The simplest of these is the *whole life annuity*, payments of which are made through the life of the individual. Next is the *temporary life annuity*, payments of which are made for a fixed period of years during the life of an individual. The *joint life annuity* is one in which payments continue as long as all lives survive, and the *joint life and last survivor annuity* provides payment as long as one, at least, of two or more lives survive. Annuities may be made contingent upon other circumstances, but those dependent upon life are by far the most common. All these "life" annuities are subject to the same classification as the *annuity certain*. They may be immediate, due or deferred; paid annually, semi-annually or for other periods and they may vary in amount. In addition, the life annuities are said to be curtate or complete. The annuity is *curtate* when payment ceases with the last annual, semi-annual or other periodical payment before death, and *complete or apportionable* if it includes a proportionate payment between the last regular payment and the time of death. The *forborne temporary life annuity* is one in which the successive payments of the temporary life annuity are not taken as they fall due, but are left to accumulate at compound interest and distributed among the survivors.

The sum of the successive payments accumulated to the end of the period during which the annuity is payable is called an *amount* of the annuity. The *present value* is the sum of the present values of the successive payments. An annuity of which the present value is k per unit of annual rent is said to be worth k years' purchase. The total amount payable in a year is called the *annual rent*.

This by no means exhibits the forms or combinations which are possible or which actually occur, nor does it completely define some of these forms of annuities. For instance, with a joint life annuity, what is to be paid at the successive deaths up to the last? The shares of co-annuitants, who have died, might return to the estate, but in actual practice, these shares are added successively to the shares of the survivors in equal portions until the

last survivor receives the whole. In contingent annuities, the most common circumstance which terminates the contract is that the annuitant shall become financially independent as by marriage or re-marriage, or attainment of majority, as for instance, when a man provides for a widow, or daughter or son by will. Here we have, of course, the disposition, by annuity, of lump sum settlements of workmen's compensation and life insurance cases.

Annuities by Object or Purpose

Annuities may also be considered according to the object of the annuity, (a) annuities providing for others and (b) annuities providing for one's self. The first type of annuity is probably the older, and is of testamentary character, taking the place of a legacy in the lump. Until recent times, these annuities were chiefly charged directly on the private property of the testator in the hands of trustees, and with certain European families this practice is still common. In Europe, these charges on property constitute an element of high social and, at times political, importance. Some entailed estates are always encumbered with many absolutely fixed annuities to family connections or dependents of the houses, while the income from which they are to be paid may shrink indefinitely as it has done in certain specific cases. This has occurred with grave consequences to such annuitants during periods of monetary inflation. *Per contra*, a period of monetary deflation such as the world is facing now may redound to the benefit of annuitants, and may lead to a revival of annuity business on a large scale. For the past 150 years the administration of annuities has been gradually taken over by incorporated insurance institutions and combined with the business of life insurance. The insurance companies pay the annuities on contracts matured at the death of the testator, the payments beginning either then or at a later specified time.

In the United States, the latter system has replaced almost entirely the old types of annuities in which incomes were bought for self or others for a term or for life, by paying a lump sum to a person, a corporation or public body, not a life insurance company.

These older individual contract annuities, although they were

based on the same mathematical foundation as the annuities administered by insurance companies, were historically of two definite types. There was one type of annuity which was bought for security of income and the other for investment or on speculation. The latter type of annuity is the older and resulted from industrial and social conditions which have since passed away. They arose partly because of the paucity of investment securities, and partly because of the laws against usury, which could be and were evaded through the purchase of annuities. It is historically incorrect, however, to assume that annuities were developed chiefly as means of evading usury laws.

The favored method of borrowing money by the medieval "companies", and municipalities and States as well, was by annuities which were sold on rough estimates of the chances of life, in which the buyers were always keener than the sellers. Until recent times the bargain nearly always ran against the payer of the annuity, especially since the sharp trend toward lower mortality rates set in. Many shrewd investors accumulated great properties by careful investment in annuities on sound lives, because they were permitted to propose the individuals upon whose lives they laid the wager. These judgments as to the soundness of lives were often based at an early period upon the advice of physicians. This practice persisted until mortality tables were constructed upon the actual experience of populations or insured groups.

The second object of insuring one's self against the chances of fortune has had one broad aspect,—such annuities were usually taken out in early life instead of being dependent upon the annual accretions of a savings fund to the point where an annuity could be bought by the individual.

The amount surrendered to the grantor of the annuity was commonly obtained through the sale of an inherited property by women, or by men of quiet tastes, to produce a sure income free from care. While annuities of this type are frequently encountered in the countries of Europe, their adoption is becoming commoner in the United States. Large, inherited fortunes have been few in this country until very recently and the desire to lead a life of ease is, fortunately, equally rare. But as family properties increase and the life struggle becomes more intense there may be greater demands upon the annuity system.

Pseudo-Annuity or "Rent Charge" Practice in Assyria and Babylon

From the researches of Trenerry, one develops the idea that in Babylon there must have been a fairly wide-spread practice of granting a series of periodic payments secured by land or other property. It is definitely known that a well-developed system of individually underwritten transport insurances prevailed in Babylon as early as 2500 B. C. Banking service seems to have been quite well developed because Babylon was a busy manufacturing centre, dependent upon India and China for raw materials and upon Phoenicia for an outlet in the Mediterranean area for manufactured goods. There were in Babylon great banking houses which existed for generations and there was also an efficient medium of exchange and what corresponds roughly to the commercial paper of our contemporary banking system. Interest was charged for loans to manufacturers and traders, and there were legal codes which, from time to time, established the reasonableness of certain rates. Annuity and other insurance practices may, indeed, have been adopted from the commercial codes of the Hindus and Chinese, antedating the Babylonian era.

Annuities in Egypt, 1100-1700 B. C.

A careful search through the legal codes of Egypt by archeologists brings forth evidence that an annuity was purchased by Hepd'efal, a Prince ruling in Sint in the Middle Empire. This time in the history of Egypt ranged from the reign of Aahmes to the close of the XX Dynasty (Sethnakt).

Annuities in Rome

There is much evidence from the available text of the Roman Civil Law that the Romans and their predecessors had the statistical material and the required skill in arithmetic for the construction of crude annuity tables. There is also evidence in the recorded decisions of the Roman Jurisconsults that the purchase and sale of annunities was widely prevalent and that some statistical knowledge was extant of the effect of mortality on the funds of the mutual aid societies which had wide vogue among the civil and military populations. According to Mommsen, the Romans of the second and third centuries A. D. were better qualified in

the arts of calculation, and had more effective ways of doing business, than did the peoples of Europe in the 16th century. The Romans had a knowledge of arithmetic, algebra, the use of interest and discount. They also had a metallic currency, a system of bookkeeping, banking facilities, and practiced instalment buying and selling.

In the *Lex Falcidia* (40 B. C.) there were provisions that the heir or heirs of an estate should receive not less than one-fourth of the total property left by a testator. It was frequently the case that the will was made at a time when the testator was in easier circumstances than at the time of his death. It became necessary in such cases to reduce proportionately the values of the several legacies. In the case of an ordinary legacy, this reduction presented no important difficulty; but when the testator had left a life annuity to one or more legatees, the question arose as to the basis of reduction of such annuities.

In order to meet this contingency of capitalizing annuities a table was set up at a time not specified. Emilius Macer was the first to place this table on record, but the evidence is that these values were used for many years prior to Macer's authorization of the table in one of his *responsa*. Macer also sanctioned at about the same time the use of another and probably more correct table, the authorship of which was attributed to the Pretorian Prefect Ulpianus (about 225 A. D.). The values in Macer's table showed that up to 30 years of age, 30 more years of life were expected. Between 30 and 60 years of age as many years of life were to be assumed as were wanted to make up 60 years. The table of Ulpianus showed distinct signs of an effort to approach more exactly the values of annuities. His table is given below.

THE TABLE OF ULPIAN

Age	Years	Age	Years
Birth to 20	30	44 to 45	15
20 to 25	27	45 to 46	14
25 to 30	25	46 to 47	13
30 to 35	22	47 to 48	12
35 to 40	20	48 to 49	11
40 to 41	19	49 to 50	10
41 to 42	18	50 to 55	9
42 to 43	17	55 to 60	7
43 to 44	16	60 and up	5

Much diligent inquiry has been made to establish whether the values shown in Ulpianus' table are those of the ex-

pectation of life or the values for an annuity of 1 per year. It would be futile to review the dispute. The scholars who insist that these figures represent the expectation of life at the various ages, maintain that the original experience was probably that of some one or a group of Roman mutual aid societies and that the computations were made by a rather clever person unskilled in actuarial work.

Although Macer's table was so openly incorrect, yet it appears to have been used quite generally; possibly because it was easier to remember and also because it gave smaller values for all ages above 50. Further reference to the *Basilikon* (the code of Basil I, 9th century, chiefly adapted from Justinian) shows an amendment introduced to render the table less unfair at the later ages. In the original form as quoted by Macer, the value of an annuity to a person aged 60 or more was nothing, whereas in the *Basilikon* the value at age 50 or over was five times the yearly payment. Both the Macer and Ulpianus tables were used, however; in fact, the latter table was the official annuity table of the Tuscan Government in Northern Italy until early in the nineteenth century.

There is some disputed evidence that the mutual aid societies of the Legions of Rome granted annuities to members who retired from military service at the age of 46. There is plenty of evidence for insurance scholars to review in the *Responsa* of Ulpianus, in the *Digests* of Justinian and in the *Basilikon* of Basil to the effect that the Romans were continually buying or selling annuities, both for life and for fixed terms, and that they had developed a species of tontine, which was pronounced illegal by Basil I.

Annuities in the Eighth to the Fifteenth Centuries

Some time after Rome fell (fourth century A. D.), the money economy which the Romans had set up almost vanished, and the then known world entered upon a goods economy. There was kept alive, however, in Northern Italy, the faint spark of a money economy, which was fanned to a full flame in the latter part of the Middle Ages by the revival of manufacture and trade, and by the re-introduction of gold as a medium of exchange after the Crusades. Since there was little manufacture or extractive effort during the early Middle Ages, there was very little use for money

as an adjunct to productive processes. When money was lent it was used chiefly for consumptive purposes. And, possibly, because of the lack of intrinsic security back of loans for consumptive purposes, interest, or the price paid for the use of money and for the assumption of risk, was high and oppressive.

Church Bans on Usury, and the Annuity

In view of the statements which have been made quite frequently that the attitude of the Church toward interest was the chief obstacle to the growth of annuities, and later of life insurance, it might be well to examine some of the claims of the Church. With the exception of c. 27 of the Fourth Lateran Council, there was no canon law of the Church which took into consideration moderate interest; and the Canon Law nowhere states that interest is under any circumstance contrary to justice. The Church Councils and the Fathers did hold that the loan of things, or of money for the purchase of things, for immediate, necessitous consumption does not legalize any stipulation to pay interest, and that interest exacted on such a loan must be returned as having been unjustly claimed. In gratuitous contracts, the Church has been opposed at all times to claims of interest. Following the development of a money economy and the demand for productive credit, the Church held that it was permissible to charge interest whenever the lender was in danger of losing his capital or of exposing himself to a loss or to deprivation of a gain. This was *compensatory* interest. And the modifying reasons which authorized the charge of interest were called *extrinsic titles*. The Church has also admitted *moratory* interest, or a fee for delay in the re-payment of capital. The present attitude of the Church as shown in the *Sacred Penitentiary*, (April 18, 1889), is "to conform to the usages established amongst honest men as precisely one does to other prices."

The edicts of the Church related primarily to usurius charges on the consumptive needs of the poor and distressed. The first edict was directed against the exaction of interest on consumptive loans by the clergy; this ban was later extended to the laity. But as we have seen, when a money economy again returned, the Church stated its position very exactly on the

justice of taking compensation for risk in the lending of capital and for the deprivation of the chance to make profit, which the lender necessarily undergoes when he assigns command over goods and services to another person.

The Church and the Revival of Rent-Charge Practice

It was the Church itself that revived public interest in life annuities during the eighth century. Monasteries and other religious bodies gave land in return for annual payments of money. The Council of Celchyth in A. D. 816 laid down a rule that the lands of the Church should not be charged for more than the term of the single life. The same restriction occurs in the deed drawn up on the dedication of the Abbey of Winchelcomb by Kenulf, King of Mercia, A. D. 811. Cardinal Henricus a Segusio, also named Hostiensis, suggested the broader elements of rent charge practice in his treatise *Aurea Summa* (1255). In 1308, the Abbot of St. Denis arranged with the Archbishop of Cologne to pay a life annuity of 400 livres to the Archbishop in consideration of 2,400 livres paid to the Monastery. In event of death during the first two years of the term of the annuity, 1,000 livres were to be re-paid to the heirs of the Archbishop.

In Italy, France and the Netherlands, there were formed certain societies which were called *Societas Sacri Officii.* These societies were formed in consequence of the system of saleable offices of the *Curia Romana* of which there were a great number. It was to the interest of the Papal finances to get as high a price as possible for these saleable offices, and the Popes permitted the clubbing together of several persons for the purpose of acquiring one or other of these offices when individual means proved insufficient. This device was formed in order to get the candidate out of the clutches of usurers. Associations of this kind were in existence as early as the time of Leo X. Abuses of this system lead to its abolition some time before the eighteenth century.

Transition from "Rent Charge" to Annuity

Early in the Middle Ages, a legal concept was formed in England that the right to a rent from a certain piece of land, was a

right capable of transference. The payment of the rent of land from a tenant to a landlord, "reserved" when the tenancy was created, was thought to be something which remained to the lessor after he had made the lease. Modifications were made in the laws governing the tenure of land enabling the paying of rent by the tenant to a third party who was not the owner of the land. It soon became the practice for a landlord to enter into a contract with a third party in respect to a certain farm on his estate, whereby, in virtue of a sum of money paid down, the latter became entitled to receive the rent while the land still remained in the possession of the owner. It was an easy step then to the purchase of the "right" to such a yearly amount unattached to any particular farm or piece of land, but simply a burden upon the whole estate. Later, property as houses, shops and rights of toll began to be "charged" as well as land. Afterwards, even movable personal property and personal credit could be hypothecated in consideration of annual payments made for a term of years or for life. In the thirteenth century such annuities were known. They were said, according to Jack, to have issued out of the grantor's chamber, "the place where he kept his treasure." In actual fact, the security for annuity payments was in these latter types solely the grantor's honesty and solvency, *i. e.*, the annuity was secured against the person of the grantor. These historic facts must have been taken into account by Lord Coke when he made his definition of the annuity in the seventeenth century. The legal literature of the late Middle Ages stipulates that there were rent charges in perpetuity, passing to heirs, (*census perpetuus*); sometimes for a period only, (*census temporalis*); limited for a definite number of years, (*census certus*); or by the death of the receiver of the rent (*census incertus*).

War Finances and the Annuity

In Germany during the eleventh century, it became customary for Counts and Barons in fighting their petty wars to hire mercenaries. Much of this expense was met by hypothecating land, with rents or annuities payable in gold. Henry I of England in 1103 secured the use of 1,000 men and three horses in return for a yearly payment of 400 marks to the Counts of Flanders. This was an early example of paying for a war on the instalment plan. In the Italian cities, the emergence of the money economy oc-

curred earlier than in the rest of Europe; in fact it never completely died out. Where the Italian cities needed money for conducting their wars, and for their other usual pursuits, they had recourse to "compera", or loans re-payable as annuities, and chargeable against the credit of these cities. Genoa, Florence and Venice used this form of funding. In 1470 Genoa had outstanding obligations of this type for more than 11,000,000 lire and in 1597 this annuity debt was 43,700,000 lire. This practice of the Italian cities lead later to the *montes pietatis*. In Germany this form of municipal financing was so lucrative that private enterprise in the annuity field was forbidden in some cities (1350).

Foundation for the Modern Annuity in Flanders and Brabant

It was in Flanders and Brabant, however, where the foundations for modern annuity practice were laid. There are existing to-day in the municipal archives of these cities evidences that the annuity business flourished in this area. In Tournai, there are on file one certificate dating back to 1229 and six for the year 1228, presumably cases where the annuitant died or the annuity was bought back by the city. There would be much more evidence on file to-day of these earlier annuity practices if the Town Hall of Tournai had not been destroyed by fire in the year 1250. Documents for the years 1304, 1323 and 1325 show that these annuities were paid at the rate of $14^3/_5$, $14^2/_7$ and $11^1/_5$ percent respectively. For the period 1396-1445, annuities on two lives were sold at $8^1/_3$ percent.

The Purchasing Power of Money and the Annuity Contract: Thirteenth Century

One of the Bruges contracts is of interest. In February, 1265, one Robert Norman of Utrecht, and his son, Baudoin, arranged for a survivorship annuity of 400 Parisian livres. The contract provided that if the purchasing power of the Parisian pound declined, the payments were to be made in the sou of Tournai at the ratio of 50 Tournaise sous to 43 Parisian livres. Consideration of the purchasing power of annuity payments may have been a quite general practice in the thirteenth century, an era

when there were wide fluctuations in the local supply of monetary gold, and consequently in gold prices. Possibly there is in this practice of the thirteenth century a suggestion which we ought to consider in insurance finance of the twentieth century. There is a distinction, in fact, between money income and real income, between legal tender, however "sound", and the flow of concrete benefits, or "money's worth", which the possession of money commands. Much evidence on this point was presented to the International Congress of Actuaries which met in London during June, 1927.

Administration of Annuity Business: Ghent

The Ghent documents contain evidence that the annuity business was regulated in considerable detail. There were provisions for the replacement of the certificate in event of destruction or loss and a penalty of ten Parisian sous against the City for each day's delay in making the annuity payments. The Ghent annuities were of the socalled complete or apportionable type. The City also reserved the right to cancel each contract on payment of 700 Parisian livres. This suggests that the annuity was paid the citizens at the rate of $14^2/_7$ percent. The widespread popularity of the annuity may be assumed from the action in 1548 of Count William of Jülich, who applied for an annuity not only on himself but "for all his towns and villages and for his lands and people."

Prior to the fifteenth century most of the annuities took the form of rent charges, sometimes involving two persons. In Germany at the beginning of the fifteenth century annuities proper were first sold; that is to say, the charge was shifted from property to persons. This change in the annuity charge probably also accompanied a similar development in England.

Early in the fifteenth century, the annuities which were sold in Amsterdam, took into account the question of age. In Leyden, a manuscript for 1449 showed that half-yearly payments were made in June and at Christmas. An official of the town would search out persons entitled to annuity payments, post a notice on the church door, set up an office and then tell the annuitants to call for their money. This is one of the early examples we have of a

just zeal on the part of an insurer to see that persons insured receive the benefits they contracted for.

Perpetual Annuities

About the middle of the fifteenth century several German cities granted perpetual annuities. This is shown by the Nürnberg archives for the years 1433 to 1458. This practice arose out of the high confidence of the people that the prosperity which Northern Europe enjoyed at that time would continue indefinitely. *Aeneas Sylvius Piccolomini* (afterwards Pope Pius II), wrote at that time that Germany was never richer, her people never more content, nor were living conditions ever better. Bishop Antonin of Florence remarked in his "*Summa Theologica*" that no one at that time had to work very hard or long to secure the necessities of life. We can understand, therefore, the confidence which the people of Germany had in the ability of their cities to pay perpetual annuities. These annuities were often on two or more lives. This annuity business was also conducted by private citizens. There is a record of annuity business privately transacted during this era in Luneberg. The type of annuity sold by these people was not specified in the records.

Annuities and the Usury Laws

The statement has often been made that rent charges were invented as a means for evading the usury laws. This is probably not true because of the antiquity of the annuity. It had precedence historically over any of the bans on interest and usury. It was true, though, that full advantage was taken of the lawful status of the annuity by monied persons who had to choose between the risk of confiscation of the whole capital of usurious loans and the safe practice of accepting periodical payments from a constructive "grantor" of an annuity. Probably the greatest force in the revival of annuity practice in the late Middle Ages was the abandonment of the system of Roman numeration (about 1150), and the adoption of Arabic numerals. Another stimulus was the translation by monks of Latin treatises on surveying and commercial calculations. The translation of Euclid's "Elements" from the Greek and the traffic between the Spanish and Arabian populations were also factors. The works

of Leonardo of Pisa (about 1200) and of the Dominican Monk Jordanus Nemorarius (1236) all lead to systems of calculation involving "interest" and other devices in arithmetic.

The invention of the printing press by Gutenberg in 1450 also had an important influence upon the dissemination of knowledge and upon the spread of current notions of annuity practice to the southern and middle German cities, thence to northern Germany, the Netherlands, England, Italy and France.

Sixteenth and Seventeenth Centuries

We have indicated that despite the ban on usury, in fact as a possible consequence of this ban, annuity practice flourished. It should be recorded that the ecclesiastical ban on usury on the Continent of Europe was also reflected in English practice. In Great Britain, the first enactment against usury was a decree of Richard I (A. D. 1197), forbidding the taking of any recompense on money lent. In view of the wholesale violations of the law, there was passed, several centuries later (1545), an Act (9th Henry VIII, c. 9) which restricted the rate of legal interest to 10 percent. This act was repealed in 1552; but in 1570, the legal rate was again fixed at 10 percent. In 1624, the legal rate of interest in England was reduced from 10 to 8 percent and remained at this latter rate until 1651, at which time, the Rump Parliament reduced the legal rate from 8 to 6 percent. This was legitimatized in 1660 and remained at this figure of 6 percent until until the year 1714 (Act 12, Anne, Stat. 2, C. 16), when it was fixed at 5 percent. It remained at that figure until the abolition of the usury laws in 1854. (17 and 18 Victoria, C. 90.)

A Dr. Thomas Wilson, writing in 1554, described in his "Discourse Upon Usury" the current practices of lending upon annuities in order to avoid the penalties of the usury law. (This book has been reprinted with an historical introduction by R. H. Tawney, by Bell of London in 1925.) During the sixteenth century much speculation in annuities was transacted by private dealers, especially toward the end of the century. There is on record the career of one Audley, who, although originally only a poor clerk earning six shillings a week, became an adept in avoiding the law, and so keen in his annuity dealings, that he became one of the richest men of his time. Much further

comment upon the abuses of the annuity system at this period in English history will be found in the writings of Francis, "Chronicle of Life Assurance" (1853).

Gerard Malynes in his book "Consuetudo vel Lex Mercatoria" (1622) discussed succinctly the annuity practice of the day in relation to the usury laws. This volume, one of the rarest comprehensive treatises on insurance extant, is said to be in the Insurance Library of Boston.

Several centers of world commerce notably Amsterdam and Rotterdam increased in activity and importance following the decline of Spanish rule and influence during the middle of the sixteenth century. Antwerp, which has been the chief exchange for marine and other insurance, had been unfavorably affected by religious warfare, by siege, and the Inquisition. What Antwerp lost, her sister cities of Amsterdam and Rotterdam, gained. By 1558, the States General developed and were making their own systems of taxation. In the early part of the seventeenth century the Dutch East Indies Company had been formed and this was the first great modern joint-stock corporation. In 1621, the West Indies Company was founded. Along with the development of world trade over these two centuries there was a strong revival of manufactures and decided briskness in annuity business.

In the municipal archives of The Hague there is an annuity register for the City of Delft for the year 1557 containing the names of annuitants of that city. An annuity certificate on file in Leyden for the year 1402 contains a death certificate signed by a physician. There is other evidence from the Leyden records that measures were taken by the States General to encourage the prompt reporting of deaths of annuitants to the Finance Minister. In the middle of the sixteenth century gratuities were offered to persons who reported deaths of annuitants to the Finance Minister. Rewards were also offered for frauds against the annuity funds. That the frauds perpetrated against the State annuity funds constituted a real problem in administering the system, is evidenced by the numerous edicts which were issued against such practices by the States General. The complaint against annuity frauds was heard also through the sixteenth and seventeenth centuries, culminating in the "Bubble Act" in 1720 in England.

About 1550, in the annuity practice of the Netherlands, life annuities on one life were offered at 16⅔ percent and on two lives at 12½ percent. That a large annuity business was done in Holland at the end of the sixteenth century is shown by a letter from John Hudde to Christian Huygens (August 18, 1671), wherein Hudde reported that he had prepared a mortality table from the experience of 1,495 annuitants in the United Provinces, upon whom annuity certificates had originally been issued during the years 1586-1591.

At the beginning of the 17th century the States General began to issue certificates with repurchase clauses. At that time, there were many persons of shrewd disposition who took out annuities in large amounts on the lives of young persons of strong constitution and the probability of a long life span. Physicians were employed by these annuity gamblers to pass on lives insured with the State Annuity Institution. It has been said that a large proportion of the annuities issued at that time were on the lives of children from 2 to 12 years of age. This wave of speculation was markedly checked later on by the rise of the socalled Tontines.

Little can be discovered on annuity practice in Germany during the early part of the 17th century. The Thirty Years War (1618-1648), the decline of trade in the North German cities, the lack of growth in the populations of these cities, the loss of their political independence, and other trials and difficulties of the times, rendered it impossible for the Germans to sustain an annuity system. Annuity practice was not entirely abandoned, however, as was evidenced when Count William of Fürstenberg brought home some 15,000 florins from some war which he had been profitably engaged in, and with it secured a life annuity of 1,500 florins from the City of Strassburg. In 1517, Hans Baldung Grün, the celebrated artist who was employed on the great altar of the Cathedral at Freiburg, secured an annuity of 25 florins, payable jointly to himself and to his wife, with a payment of 350 florins. The contract had the provision that at the death of either husband or wife, half the annuity was to be paid.

In Italy, there was evidence of the widespread practice of granting annuities based on loans. Benvenuto Cellini in his autobiography relates that in the year 1552 his fortune had suffered by the political intrigues of the times and that he was compelled to seek settlement of a debt of 1,200 gold thalers. He

secured, in settlement, an annuity of 15 percent. Cellini speaks of other contracts entered into for the payment of rent-charges based upon land owned by him.

TONTINES

The rise of tontines in the 17th century caused a gradual decline in annuity speculation on the Continent. The tontine was devised by Lorenzo Tonti, a Neopolitan physician and adventurer, who made a proposal to Cardinal Mazarin to resuscitate the French finances toward the end of the 17th century. His plan was as follows: A fund of 25,000,000 livres was to be collected and each year interest to the amount of 1,025,000 livres (4.1 percent) was to be paid thereon from the income of the state. The subscribers of the fund, or entrants, were to be divided into ten classes according to age; the ages below 63 were divided into nine groups, each consisting of seven consecutive years of age. Those above 63 were placed with the tenth class. Each "class" was to receive an annual payment of 102,500 livres. Contributions to the fund were greater for younger than for older persons and the interest rate was adjusted also according to age, a lower rate of return than the general average of 4.1 percent for the whole fund being paid to members of the younger class at entrance and a higher rate to those entering the fund at the higher ages.

Each class constituted a closed group or "pool," surviving members of each class receiving pro rata shares in an interest fund of 102,000 livres, which was distributed yearly to each class until the last member passed out of observation. After the death of the last member, the original fund reverted to the state. While Mazarin regarded the proposal favorably, the plan could not be established because of difficulties between the French King and Parliament. Tonti then attempted to promote his scheme through a lottery. Nothing came of this, however. Colbert, the French Minister of Finance, thought so little of the plan at the time Tonti invented it, and his opposition aggravated Tonti so greatly, that in 1669 Tonti wrote a pamphlet which landed him in the Bastille. It is said that Tonti died in prison about 1695, poor and forgotten.

The idea did not die, however. In 1670 the Dutch city of Kampen floated a tontine of 100,000 florins in 400 certificates of

250 florins each. This whole issue was bought up by one Jacob Van Dael, somewhat in the manner of the modern banking syndicate. A pamphlet or prospectus was published by Van Dael in which the following *prospective* survival table of the 400 annuitants was set forth.

VAN DAEL SURVIVORSHIP TABLE, 1670

Years	Number of Survivors
1	400
12	200
24	100
36	50
48	25
60*	12
64	8
68	5
72	3
76	1
80	0

*From the 60th year on the decrement is one death for each year of experience in the original table.

Van Dael suggested that no interest be paid to pool members until 24 years had elapsed; then 15 percent was to be paid. After 36 years, 32 percent; after 73 years, 400 percent, and after 80 years 1,600 percent was to be distributed to the survivors of the original 400. There was no mention of Lorenzo Tonti in Van Dael's pamphlet.

In 1671, the City of Amsterdam issued a loan of 50,000 florins in 200 certificates of 250 florins each. From the record we learn that after 38 years, the annual income of each survivor had doubled, at the end of 46 years it had trebled and after 67 years, *i. e.*, in 1738, the annual income to each survivor was ten times greater (80 percent) than at the inception of the scheme. The actual survivors in this Amsterdam pseudo-tontine were as follows:

Year	Survivors	Year	Survivors
1671	183	1706	100
1676	172	1711	97
1681	166	1716	64
1686	154	1721	52
1691	144	1726	40
1696	127	1731	27
1701	116	1736	22
		1746	20

In 1671, Van Dael also floated two similar tontines for the City of Groningen.

In 1674, there was issued in London a scheme of tontine annuities whereby sums in units of £20 were to be accepted and subjected to "so great an increase by survivorship as will most certainly accrue to many persons and especially to the longest liver of this rank."

In 1653, Paul Klingenberg, Postmaster-General of Denmark, a friend and co-worker of Tonti, attempted to found a tontine with the help of the Danish Government. The project failed, but incidentally it attracted attention to financial operations dependent upon human life contingencies. Tontine practices survived into the eighteenth century and so are significant chiefly because they represented a transition from the period when life annuities and gambling insurance declined, to a period when modern life insurance on an actuarial basis, arose.

John de Witt and John Hudde

John de Witt was one of the outstanding personalities in this era of transition from the calculation of annuities on a guesswork basis to one based upon calculations which took into account the probable duration of human life. De Witt was born in 1625, educated at Leyden where he came under the influence of Van Schooten, an eminent mathematician. After a period of travel, De Witt studied at Angers where the degree of Doctor of Laws was conferred upon him. In 1647 he went to The Hague, occupying himself with mathematical studies, conducting a generous correspondence with Van Schooten and from time to time with Des Cartes. In 1653, De Witt became syndicus for Dordrecht in the Parliament of Holland and West Friesland. For 22 years he served as the head of the Government of his country. His efforts made Holland not only one of the most important of the seven United Provinces, but a mighty and respected force among European nations. William III, of Orange, while King of England, declared that De Witt was the greatest of statesmen and had served his country truly and well. The student of politics will find much of interest in studying the administrative achievements of De Witt. We shall have to limit ourselves, however, to his handling of the Dutch finances through state annuities.

In 1648, Holland had a state debt of 140,000,000 florins outstanding at 5 percent. De Witt took hold of financial affairs after 1653; by 1668, he had reduced the annual interest charge of 7,000,000 florins, by two-thirds. This followed his conversion of the state debt which began in 1655. In 1670, war threatened. Holland was surrounded by enemies who coveted her trade. In order to place the Army and Navy in condition, the Finance Commission proposed numerous measures for raising money among which proposals were mentioned: a loan of 3,000,000 florins at 4 percent, maturing in 41 years; a tontine for 41 years on the Kampen Plan; a similar loan for a duration of 10, 20, or 30 years, for persons who desired to buy short term obligations of the state. There was also a proposal for doubling the tax on flour products for one year. These and other proposals were made to, and were discussed quite fully by the Parliament, but the longer the debate continued, the deeper were the difficulties.

At length, De Witt told the Parliament flatly that it had been discussing problems and presenting resolutions which could be handled only with the help of mathematics. On April 25, 1671, the Parliament resolved to negotiate funds through the medium of life annuities. On July 30, 1671, De Witt presented to the National Assembly, a report explaining the basis upon which an enterprise could be carried out,—the presentation of his famous monograph "Waardje van Lyfrenten naer proportie van Losrenten." This treatise was first brought to the attention of the modern insurance world by Mr. Frederick Hendricks, who discovered the document itself. The treatise contained also, an interest table by Bellechieri and Lense and the table of mortality upon which the monetary calculations were based. The system of valuation was the same as the fifth method proposed by Tetens, the Dane. De Witt pointed out that his table presented the minimum values which the States General should accept, if the annuity scheme was to succeed. While there were many expressions of gratitude and appreciation from members of the Parliament for the work which De Witt had done, the plan was not adopted because of the opposition of political enemies. The De Witt plan had appended to it the certificate of John Hudde.

Much of the political opposition arose out of the fact that the prices set for annuities under De Witt's plan were to be higher than the Hollanders had been accustomed to pay or which they

thought were necessary. For one thing, De Witt's enemies charged that he had enriched himself through his contact with the state finances, a charge hard to believe, because of his secure, private financial position. These charges and others relating to his general conduct of the affairs of State, the heavy taxes necessary to the conduct of the war, caused strong opposition from the people. On August 20, 1672, De Witt was murdered by one Pöbel.

Leibnitz appears to have been one of the first to draw the attention of persons on the Continent of Europe to this report of De Witt's. It was, however, not well known in England. Both De Witt and Hudde labored not for their times but for later generations. De Witt's treatise has since been reprinted about thirty times. Four copies of the original treatise are known to exist.

Other events in the 17th century which had some bearing on the development of sounder annuity practices were the publication by William Webster in 1620 of his table of compound interest, "The True Valuation of Annuities, Leases, Fines, and Reversions"; the interest and annuity tables of William Purser in 1634; Hodder's book on arithmetic with its annuity table, 1661; Clavell's annuity table, 1669; the work of Pascal, Fermat and Huygens on the doctrine of chances in the middle of the seventeenth century; and the inception and development of vital statistics. Huygens' treatise, "Doctrine of Chances" was the first systematic discussion on probabilities which suggested ways and means of valuing life annuities. Later in the seventeenth century there was the work of Michael Dary, 1677, a paper by Adam Martindale published in the *Philosophical Transactions*, and the treatise by Mabbot, of Kings College, Cambridge, 1686.

This treatise by Mabbot contained tables for the renewal of leases and for the purchase of life annuities and was at first attributed to Sir Isaac Newton. The Mabbot tables were the first life annuity tables to be offered for public use in Great Britain.

In 1692, the first attempt was made by the English Government to raise money by means of life annuities and in connection with this effort there appears the first mention of life annuities in the English Statutes. Through the "Million Act" (4 William and Mary, c. 3) it was proposed to raise £1,000,000, to carry on the war against France, by means of tontine annuities, for the

interest upon which £100,000 payable annually was to be set apart until A. D. 1700, and then £70,000 annually. In the event that the entire million was not subscribed by a given date, those who had subscribed were to have, in lieu of tontine advantages, an annuity of £14 in respect to every £100 subscribed for the remainder of their own or nominee's lives. There were no provisions or restrictions as to age. Some £882,000 were raised by means of this method. In connection with this Act a table of prospective survivors was made up which showed the expected number of persons who would die out of 10,000 annuitants, in each year from 1694-1792. There are some suspicions that the astronomer Edmund Halley had something to do with the invention of this table. Since the entire £1,000,000 was not subscribed to, another Act was passed in 1693 granting life annuities also at the rate of 14 percent per annum. The actual experience of this batch of annuitants was tabulated by Mr. John Finlaison in 1829, along with his valuation of a number of other tontines issued in subsequent years by the British Government.

Vital Statistics and the Annuity

Mention has been made of Edmund Halley. And this suggests at once that the development of vital statistics had an important bearing upon the preparation of the first annuity table (Halley's) which took into account the probable duration of human life as computed from mortality tables drawn from the experience of populations.

The Council of Trent had ordered (1545-1563) that parish priests keep a record of baptisms and marriages. Pope Paul V in 1614 ordered that a register of funerals or burials be kept also. At about the same time the Evangelical churches of Germany began to keep records of baptisms, marriages, and funerals. In Frankfort such a record was ordered in 1531 and established in 1551. Leipzig and Hamburg kept these records as early as 1595-1603. England also started the ecclesiastical records in 1538. The London Bills of Mortality which assumed so important a part in Dr. Richard Price's early actuarial work for the London Equitable, were established about 1592. On January 25, 1622, John Graunt published his "Natural and Political Observations Upon the Bills of Mortality of the City of London,"

the first treatise to discuss and to present somewhat in the modern manner, the data which afterwards were called "vital statistics."

After Graunt came Sir William Petty with his "Observations on The Dublin Bills" (1683) his "Political Survey and Anatomy of Ireland" (1691) and his "Political Arithmetic" (1690 and 1711). In the same century with Graunt and Petty there came a group of scholars in many fields whose emphasis upon induction and whose researches in mathematics and mechanics, encouraged numerous inquiries in the natural sciences and in political economy.

The first life table based upon recorded mortality in modern form was published by Halley in 1693 from materials collected by Kasper Neumann, the Breslau theologian. Neumann's inquiries came to the attention of Mr. Justell, Secretary of the Royal Society, probably through the offices of Leibnitz, the mathematician. The materials which Neumann sent to Justell were used by Edmund Halley in building the Breslau Life Table. Later the German mathematician Euler gave considerable attention to a refinement of Halley's method.

Halley not only constructed a mortality table but he laid down most clearly and distinctly the principles on which a life table should be constructed, and by so doing, contributed the cornerstone of actuarial science. While his actual methods were laborious he succeeded in presenting a table of annuity values at five-year age intervals as being "the short result of a not ordinary number of arithmetical operations."

The principles which Halley established did not, at once, enter into the plans of those who conceived the various annuity schemes which became a veritable public nuisance at the beginning of the eighteenth century. Halley's annuity table was the first to utilize mortality data drawn from actual experience, as well as a compound interest table. Halley had the advantage of Stevin's compound interest table and of Sherwin's logarithms in carrying through his annuity computations. He did not have, however, the use of commutation columns which later proved to be so helpful in annuity computations. These were invented by John Nicholas Tetens, a Danish mathematician and actuary about whom more should be known. American actuarial students ought to know that until the end of the nineteenth century in Germany, Teten's work "Introduction to the Calculation of Life Annuities," was considered to be the classical and

standard textbook on actuarial science. This text was written in 1786 and was reprinted in several further editions. Teten's pupil, Struve published in 1803, and in 1806, a further treatment of the same subject. (Tetens' work was superseded by Zillmer's "*Mathematischen Rechnungen bei Lebens-und Rentenversicherung*", Berlin, 1861 and by Zillmer's later "*Beiträge zur Theorie der Prämien-reserven bei Lebensversicherungsanstalten*").

In 1698, an annuity project was set up by the Mercers Company of London mainly at the instigation of Dr. Assheton. The plan was to grant life annuities to the widows of the members at the rate of £30 for every £100 paid down by the member of the fund. In 1699 or 1700, another similar institution was formed under the name of the "Society of Assurance for Widows and Orphans" which has long since passed out of existence. The treatise of John Ward of Chester, England, in 1698 on algebra, contained an appendix which had in it a discussion of compound interest and annuities. In 1703 an act was passed in England in which life annuities were granted upon a similar plan to that in the Mercers Company but on less unfavorable terms to the purchaser. But the annuities granted under this act were subsequently taken up by the South Sea Company. In 1704 another act was passed for raising money by the sale of annuities as a war measure.

Annuities in the Eighteenth Century

This century was to mark the decline of annuity schemes based upon guess-work, high expectation, and the sort of literary exploitation which today is known as "high-pressure salesmanship". The work of Halley, DeMoivre, Simpson, Dodson and Price through this century established the landmarks of modern life insurance. In 1705 the Amicable Society for Perpetual Assurances was established. It was incorporated by Royal Charter in 1706. The plan was to raise a fixed contribution from each member and from the proceeds, to distribute a certain sum each year, to the representatives of those that died during the year. No one was to be admitted under the age of 12 nor above 55 (afterwards lowered to 45) for all were to pay the same contribution. In 1734 the Society made arrangements for guaranteeing that the "dividends" for each deceased member should not

be less than £100. This was the first approach to assurances of a definite sum at death, whenever that might occur. The minimum dividend was afterwards increased, but still the Society adhered to the plan of rating all members alike, irrespective of age.

The dissatisfaction of Dr. James Dodson with this plan of the Amicable, led to the formation of the Equitable Life Assurance Society of London in 1756. Dodson found himself ineligible for admission to the Amicable on account of his age and he, therefore, interested himself in the project "to form a new society upon a plan of insurance of more *equitable* terms than those of the Amicable, which takes the same premium for all ages." Dodson's scheme gained the support of a number of persons and application was made for a Royal Charter. This was refused on the report of the law officers of the Crown on the ground that the scheme was too speculative. The Society was started, however, without a Charter under the name of "The Society for Equitable Assurance on Lives and Survivorships." It was to issue policies for the assurance of fixed sums on single or upon joint lives or on survivorships and for any term. At its inception, the Equitable Society conducted an annuity business. *Premiums were to be regulated according to age and lives were to be admitted with due regard to their state of health and other circumstances.* Provision was made for the investment and accumulation of funds and also (somewhat imperfectly) for the disposal of surplus.

Dodson, unhappily, did not live to see the project carried into effect; but in spite of its many original defects which had to be removed by experience, the edifice he erected remains to this day one of the most distinguished of life insurance institutions.

The famous interest tables of Smart appeared in 1707; a second edition was published in 1726 and this contained an appendix on annuities, with a suggestion for the improvement of the London Bills of Mortality. In the same year, Charles Povey, the founder of the Sun Fire Office, proposed a curious scheme "The Proprietors of the Traders Exchange House." At the end of the first five years, 50 of the poorest members were to receive an annuity of £10 for life; after another five years the other members were to receive the same grant. Povey was one of the most eccentric and remarkable characters in insurance history. His exploits have been fully set forth by Mr. E. R. Hardy in his book

"Making of the Fire Insurance Rate," Spectator Company, New York.

The year 1710 was marked by a lottery drawn in London, consisting of 150,000 tickets valued at £10 each; each ticket was entitled to an annuity for 32 years, the blanks to 14s. per annum, and the prizes to various annuities arranging from £5 to £1,000. In the same year, John Ward's "Clavis Usurai, or a Key to Interest," was published. Edward Hatton's "Index of Interest" appeared in 1711. This was the first attempt to popularize the arithmetic of life annuities. Thomas Langham's "Tables of Simple and Compound Interest" were also published in the same year but contained no reference to life annuities. There was some material on the present value of sums of money, of annuities, and leases, calculated at various rates of interest.

In 1714 several proposals were made for raising capital for questionable mercantile enterprises by means of annuities. Under date of January 15, 1714, it was proposed to raise £20,000 on annuities for 14 years *at 50 percent per annum* "upon a good and solid security" to finance the extraction of oil from beechnuts! On January 26, of the same year, a proposal was made to raise money through annuities for the purpose of "raising a stock to improve the fishery." This Fishery scheme reappeared in 1716.

In 1714, also, we hear again of the scheme built on the plan of the Mercers Company project which was mentioned for the year 1698. It was discussed in a very lengthy prospectus, wherein 40 percent per year was "not rashly offered by the proposers, or without due consideration," but tables had been calculated to "prove" the practicability of the plan! The public was invited to accept the proposal provided it would give itself the time and trouble to examine it. Walford, who did "take the time and trouble to examine it" closes his observation with "Most virtuous, most noble, and most foolish proposers!" The full detail of this scheme is given in Walford's Insurance Cyclopedia, Vol. I, p. 110.

Another wild annuity contrivance was proposed in 1716 whereby subscriptions were to be received to establish a *Publick Treasury* to grant annuities for life and to loan money upon real security to wholesale dealers, shopkeepers, and others; also, to pay the King's customs for merchants for goods imported, without interest, "the Treasury only taking the discount for

prompt payment allowed by Acts of Parliament." While some capital was subscribed, the matter was held in abeyance until 1720, a fateful year for such schemes.

The Mercers Company issued another notice in 1717 wherein it was stated that payments were to be made at the rate of 25 percent per annum to the widows of subscribers. That the time was drawing near for the dissolution of many of these fanciful schemes is shown by the experience of one Augustine Woollaston of Fleet Street, London, who "did in August of 1716 put out proposals to grant annuities for the term of 14 years, payable half-yearly, after the rate of 20 percent per annum. This, therefore, is to acquaint all persons that the said Augustine Woollaston will not grant anyone annuities after the 26th of this instant, October."

Annuity Frauds, 1698-1720

In 1718, the author of "The Political State of Great Britain," brought out a number of definite charges as to annuity frauds. He specified that there had been many frauds by false certificates that certain persons were alive. Persons of the same family name took upon themselves the given name of some annuitant. (This has happened in the annuity experience of British Companies comparatively recently!) The author suggested various means whereby these wrong practices could be checked. The full detail is given by Walford in his *Insurance Cyclopedia*, Vol. I, p. 114. A meeting was called of all persons concerned in annuity funds to meet on November 24, 1718, "to consider and consult together of this or some other proper method to prevent these frauds." A committee was appointed to supervise an investigation. This committee brought in ten recommendations for the prevention of imposition upon the annuity funds. The next step was to publish a pamphlet "New Proofs in the Supposed Frauds in the Survivorships," which contained a series of discussions under 11 distinct subjects. Much of this discussion led to the restrictive action which was adopted in 1720 and which will be referred to later.

A subscription of £1,200,000 was proposed in 1719 for granting annuities for life and for assuring lives, the purpose of the subscription being to provide money to better the water supply of York-Buildings and Westminister in London. The water com-

pany which had supplied water from the Thames River (established October, 1691, on a charter granted by Charles I, in 1674), required funds for the extension of its facilities.

Toward the close of 1719 a Thomas Burgess proposed a subscription of £1,200,000 for securing annuities, settling jointures and assuring lives. A petition was presented to the King in Council by Sir James Hallet and others, praying for a charter of incorporation. This petition was opposed by the Amicable Society.

Proscription of Unsound Annuity Practice, 1720

In the same year, the national finances were at a low ebb. The life annuities granted at the close of the preceding century were in arrears and what had seemed originally to be bargains for annuity buyers began to take on a dark, forbidding and uncertain aspect. But apparently an easy way out of the difficulty seemed to be at hand. The South Sea Company was rising to the height of its power. Its Governors, with the King at the head, were ambitious to grasp control of the national finances. They offered to the short term annuitants of the Government (32 years) South Sea stock to the amount of 11½ years purchase, with additions in South Sea stock to the amount of the arrears on the annuities. This was quickly taken advantage of by the disgruntled and despairing annuitants. Early in the following year (1720) a similar arrangement was made with regard to many other classes of annuitants. The burden which was apparently eased from the Nation to the South Sea Company was in the amount of £666,821 per annum. After 1720, however, the South Sea bubble burst. One can imagine the plight of the annuitants.

The year 1720 marked the beginning of the end of the era of inflated annuity proposals. Early in the year (January 11, 1720) a proposal for an annuity capital of £100,000 was made and this was known as "Baker's Annuities." The Rainbow Coffee House scheme for £1,200,000 was launched on February 6, 1720 and the Draper plan for £1,000,000 on February 23. There was a further scheme, the Robins Coffee House plan for £1,200,000 to be advanced on goods, stock, annuities and talleys. On July 12, 1720, however, the Lords Justices in Council met and after taking the many proposals under consideration, ordered the petitions for incorporation to be dismissed. On February 22,

1720, the journals of the House of Commons show that a committee was appointed "to inquire into the several subscriptions for fisheries, insurances, annuities for lives . . . and to inquire into all undertakings for purchasing joint stock . . . and that it report the same . . . to the House." The preliminary report of this committee on March 18, 1720, said that several persons concerned in this undertaking, "had endeavored by corrupt and other undue practices to obtain charters to carry on their projects." The final report of the committee was issued April 27, 1720.

As a result of this inquiry, there was enacted (6 George I, c. 8), the so-called "Bubble Act," which placed a damper upon all these nefarious schemes. The South Sea bubble burst soon thereafter and more than a half century followed in England before there were any more important annuity schemes offered. Thus, half a century was devoted by scholars to the perfection of the scientific basis for the computation of annuity and life insurance tables.

Abraham DeMoivre

There came definitely into insurance history in 1724 the name of Abraham DeMoivre. DeMoivre was a French Jew born at Vitry in Champagne, France. After the Edict of Nantes, he removed with his parents to England (1688). He was a gifted mathematician who laid the foundation of the theory of functions. His first work (1711) "De Mesura Sortis" was a treatment of certain questions in the theory of probability. After the fashion of the day, he busied himself with questions in games of chance; in fact, he used to hold consultations with gamblers in various London Coffee Houses. In 1718 his celebrated treatise "The Doctrine of Chances" appeared and of this text, there were three editions.

His text "Annuities on Lives" was first published in 1724 and was also issued later on in four editions, with incidental improvements. But the name of De Moivre is chiefly associated with his well known hypothesis: that out of a given number of persons living an equal number will die each year until all are extinct. He appears to have been well aware of the nature of this hypothesis and to have made the assertion that with a more bountiful supply of mortality data some other hypothesis or law of mortality would be developed. In view of this reservation by DeMoivre

himself, it is hard to understand why the "hypothesis" has been taken so seriously by various commentators. He first investigated Halley's tables and pointed out how the laborious processes employed by Halley could be shortened. We probably owe to DeMoivre the phrase "expectation of life." The fourth edition of his treatise on annuities (1756) with which was combined the third edition of his "Doctrine of Chances," has been translated into German by Emanuel Czuber. This edition with many marginal notes by DeMoivre was published by a friend according to an agreement which had been made with DeMoivre in the year before his death. DeMoivre died November 17, 1754, poor, deaf and blind.

The year 1726 was marked by the appearance of Richard Hayes' treatise "A New Method of Valuing Annuities Upon Lives." This work was of importance chiefly because it was one of the first popular and arithmetical demonstrations of the annuity principle. Halley and DeMoivre had each explained the methods of calculating annuities but neither had supplied a complete table. A new edition of Hayes' work was published in 1746 in which he admitted that life insurance was simply an annuity reversed. In 1729, the third edition of Mabbot's "Church Leases" was published.

John Richards published his work "The Gentleman's Steward" in 1730. This was the first time that annuity values for two or three lives, made by actual calculation on observed experiences, had been published. It is rather interesting that these early popular arithmetical discussions of the annuity were called in existence chiefly for the purpose of estimating the values of leases on lives and for other dealings in connection with estates and tenures, and not strictly for annuity purposes. It will be recalled that the Bubble Act of 1720 placed a damper upon annuity schemes. Edward Lawrence's treatise on "Estates Upon Lives" was published in the same year and contained Dr. Halley's annuity table.

In 1735 Gael Morris published his "Tables for Renewing and Purchasing of Leases and Also for Renewing and Purchasing of Lives." He used Halley's table at 4 percent and popularily illustrated the application to life leases of certain of DeMoivre's problems.

In 1737, a Weyman Lee, published anonymously, his "Essay to

Ascertain the Value of Leases and Annuities." In the following year, in a new edition, the name of the author was revealed. The book contained many errors which were corrected in a new edition in 1751. But in both textbooks, Mr. Lee persisted in his error that the value of a life annuity at any age is the same as the value of an annuity certain for as many years as the expectation of life at that age. Many other persons have held this view, and a clear demonstration of the inherent fallacy in Lee's assumption was set forth by Hare in the following century.

Kersseboom's Tables, 1738

The first of Kersseboom's three tracts on "Mortality Observations in Holland" was published in 1738. In 1742, the second and third tracts appeared. These tables were constructed from the registers of many thousands of life annuities in Holland which had been kept for upwards of 125 years. The annuity values based on Kersseboom's table were judged by Milne to be of doubtful value since Kersseboom neither published the whole of the data from which the table was formed, nor explained the manner of its construction. In 1738, John Smart, author of the famous interest tables, published a table of mortality drawn from the London Bills of Mortality for the ten years 1727-1737. This table is not very well known, although it was the first mortality table deduced purely from English data. In order to condense discussion, a list will be given of the minor publications on annuities during the remainder of the 18th century.

1739 John Richards, "Annuities on Lives."
1741 John Ennis, "Arithmetic of Annuities."
1747 James Hodgsin, "Valuing of Annuities upon Lives Deduced from the London Bills of Mortality."
1753 James Hardy, "A Complete System of Interest and Annuity,"
1754 S. Stonehouse, "The Valuing of Annuities on Lives."
1754 Edmund Hoyle, "An Essay Towards Making the Doctrine of Chances."
1762 Benjamin Webster, "The Complete Annuitant."
1763 Benjamin Martin, "Decimal Arithmetic."

In 1740 Struyk, a Hollander, published a folio work in Amsterdam in which he gave two tables deduced from separate observa-

tions on the lives of male and female annuitants. These were obtained from the registers kept for about thirty-five years in that city. The tables taken jointly differed little from the table of Halley, but showed a greater mortality than did Kersseboom's table. In 1741, John Peter Süssmilch, a Lutheran Military Chaplain, published his "Die Göttliche Ordnung" wherein he offered a life table. This was not as good as the Halley table and von Baumann endeavored to improve it in 1755. This was practically all of the investigation into mortality which had been done in Germany during the 18th century.

Thomas Simpson

Thomas Simpson, another of the great minds in insurance history, published his "Doctrine of Annuities and Reversions" in 1742. Simpson, like DeMoivre, had also written on the doctrine of chances and he regarded his life contingency problems as so many applications of the principles of that doctrine. We owe to Simpson the use of the word "decrement" for expressing the number who die in a life-table year of age, out of a given number alive at the beginning of the interval. He was the first author to recall Halley's emphasis upon the proper place in the discussion of problems involved in life contingencies of the actual facts of a mortality table and to discourage the use of "hypotheses" and so-called "laws of mortality." He advanced actuarial science by providing the formula for deriving the annuity value at any given age from that of an age one year older. He incurred the wrath of DeMoivre, however, who seemed to think that Simpson's labors were superfluous in a field which he, himself, had cultivated. Simpson's publication "The Nature and Laws of Chance" in 1740 led to the preparation of his later work on annuities in 1742. In his treatise on annuities he also gave a table of mortality deduced from the London observations.

In 1744, DeMoivre, presented to the Royal Society in the form of a letter to William Jones, a paper in which, among other things, he endeavored to determine the value of life annuities when a proportionate payment is allowed according to the interval between the payment and the date of death, that is to say, he dealt with the "apportionable" or "complete" annuity.

Hardwicke and the Re-Purchase of Annuities

In 1745, Lord Chancellor Hardwicke decided in the case of Lawley *v.* Hooper, that the grant of an annuity for life, containing a clause for redeeming or repurchasing the annuity on six months' notice, was a mere loan, and usurious, and he decreed redemption of the payment or purchase money at legal interest. On this occasion, the Lord Chancellor said "I really believe that ninety-nine in one hundred of these bargains are nothing but loans put into this shape to avoid the statute of usury."

Under the authority of 19, George II, c. 12, it was arranged to raise a certain sum of money on annuities and by a lottery. The annuity provision of the act (Section 64) provided for the sale of annuities at 13 percent for one life and 4 percent for perpetuity. A very large proportion of the capital was supplied by Hollanders who, almost without exception, nominated children and in a decided majority of the cases, girls. They seemed to have studied carefully Kersseboom's third essay or tract which appeared in 1742. These results showed a decided superiority in the mortality of females. The English contributors, on the other hand, were selecting nominees indifferently as to sex and age, some lives being proposed up to ages 50 and 60. These lives were included under Mr. John Finlaison's review of 1829.

In 1746, M. de Parcieux published his famous and very popular essay on the probable duration of human life. His results were deduced from the mortuary registers of different religious houses in France and from the lists of the nominees of the French tontines. In this work he also showed a table of the value of annuities on single lives, at three rates of interest, calculated from his table of mortality for the tontine annuitants. The work also contained an algebraical theory of annuities.

James Dodson

James Dodson, another of the outstanding personalities in the development of actuarial science during the 18th century, published Volume I of his *Mathematical Repository* in 1848. In this work he strongly recommended the hypothesis of DeMoivre as the best means of determining annuity values *until the results of the London Bills of Mortality should be more dependable.* The second and third volumes of this *Mathematical Repository*

appeared in 1753 and 1755, respectively. In 1754 Dodson published his work "Concerning the Value of an Annuity for Life," and in 1757 in the *Philosophical Transactions* he published a paper "A Table of Annuity Values." Dodson seemed to have had a thorough mathematical and general scientific training. He studied annuities with DeMoivre. In 1742 there appeared his tables "The Anti-logarithmic Canon." He later became a teacher of mathematics in a school of navigation, and a member of the Royal Society. Dodson's *Mathematical Repository* would make a good text for actuarial students even at the present time. The writings of DeMoivre and Dodson awakened, in England, a vigorous interest in the scientific approach to most of the problems of life insurance and actuarial science.

In 1752 Dr. Thomas Simpson published his "Select Exercises." It was a supplement to his work on the "Doctrine of Annuities." This tract gave a new table of annuities on two joint lives and on the survivors of two lives. There is also shown a mortality table calculated on the London Bills of Mortality. It may be mentioned in passing that the book of James Hardy, published in 1753, "A Complete System of Interest and Annuities," *mentioned for the first time insurance on lives*. Hardy was, however, a disciple of Weyman Lee, the gentleman "who refused to be convinced that he was wrong." In 1753, also, James Dodson, in a letter to the Royal Society proposed a simpler method than that of DeMoivre for computing the value of an "apportionable" or "complete" annuity.

"An Essay on Insurance," by Nicholas Magens, a merchant of Hamburg, was published in London during 1755. This essay, in two volumes, is in the Insurance Library of Boston. These two volumes, are, by far, the most important treatises ever published on insurance, considering particularly the need of times when the treatise was prepared. In the opinion of Dr. Frederick L. Hoffman, the work will ever remain a classic of the highest merit in insurance literature. The first volume explains the nature of the various kinds of insurance practiced by the then commercial states of Europe, and shows their consistency and inconsistency with equity and the public good. In 1756, Dodson contributed to the *Philosophical Transactions* a table of annuity values based upon a compound of the Breslau Table and of a table based upon the London Bills of Mortality. This com-

pound table was constructed by a Doctor Brackenridge, whose name is not otherwise known in insurance history.

We have previously referred to the formation of the Equitable Life Assurance Society of London in 1756, and to the part which James Dodson had in forwarding the plan.

On January 11, 1759, the Presbyterian Ministers Fund was founded in Philadelphia, Pa. While the original purpose of this corporation was for the relief of poor and distressed Presbyterian Ministers and of their widows and orphans, the corporation later on specialized in annuities. In fact, from 1845 a special feature of the work of this organization was the underwriting of annuities. Until 20 years prior to 1875, the name of the corporation was "The Presbyterian Annuity Company." But since 1875 this organization has become quite prominent in life insurance for clergymen and has had a singularly successful experience.

The year 1760 was marked by the appearance of Euler's formula by which the value of an annuity on a single life could be derived from that of an annuity on a life one year older. This formula had been given by Mr. Simpson 18 years before, for effecting the same purpose, in the case of any number of joint lives.

In Germany during 1765, Lambert published the first part of his treatise on annuities. The third part was not published until 1772. During the same year in London, the London Annuity Society was founded and in 1776, the Laudable Society of Annuitants, was established.

Dr. Richard Price, a noted Unitarian clergyman, and later one of the staunchest friends of the independence of the American Colonies, published in 1771 the first edition of his work "Observations on Reversionary Payments; on Schemes for Providing Annuities for Widows, and for Persons in Old Age," to which was added "Four Essays on Different Subjects in the Doctrine of Life Annuities and Political Arithmetic." The date of this work has been erroneously stated by some authors as 1762 and by others, 1769. Dr. Price, in 1771, and a Mr. William Dale in 1772 drew very marked attention to the promises which had been set forth by several of the London annuity societies. These two men proved that the annuities proposed were much larger than the subscriptions justified and through the controversy which ensued, the science of life contingencies became, in a

measure, popularized. In this same year, the British Government again raised a further sum by the sale of life annuities and a lottery. John Finlaison included the results of this annuity project in his "Observation No. 2," 1829.

About this time numerous small annuity societies were projected in London and in the provinces, all of which met with vigorous condemnation by Price and Dale. Cornelius Walford was the first to direct attention to the work of Dale, who, it appears, was a member of one of the annuity societies and wrote from direct observation. It seems that the fame of Dr. Price really caused Dale's work to be passed over.

In 1772, Baron Francis Maseres published "A Proposal for Issuing Life Annuities in Parishes for the Benefit of the Industrious Poor." A bill was introduced in Parliament in 1773 with a view to the development of the project, but this resulted in no definite action.

The Reverend William Gordon, a clergyman in Boston, proposed, in 1772, a plan for a society "For Making Provision for Widows by Annuities for the Remainder of Life." This document is one of the rarest publications on insurance extant in America. Mr. Gordon in a sermon preached in Boston in 1777, argued in favor of extending life insurance to the general population but nothing came of it, except that some encouragement was given to the promotion of tontine schemes which came perilously near being in conflict with the British law at that time.

William Morgan, the nephew of Dr. Richard Price, published his "The Doctrine of Annuities and Assurances on Lives and Survivorships," in 1779. In the same year, a number of annuity proposals were made to the American Colonial Congress. Lotteries were quite common at that time in the colonies and absorbed most of the savings of the people. It had been resolved in the Congress in April, 1779, "that funds be borrowed on the credit of the United States in annuities on one and two lives, without distinction of age and that the annuity should not be less than $50 on one life and $70 for two lives yearly income. Strangers not naturalized, or citizens, or the subjects of any nation or country could acquire the said annuities and should not be likely to forfeiture or confiscation even in the case of war between the United States and the country to which the annuitant should happen to be a citizen." No action was taken in the

matter by the Congress but it is significant that this seems to have been the first suggestion in our country for governmental funding on the annuity plan. This item was extracted from the Journal of the Colonial Congress by Dr. Frederick L. Hoffman and further details will be found in his work on insurance science and economics.

Attention should be directed to the elaborate treatise on insurance by John Weskett which appeared in 1781. According to Hoffman this work is a particularly clear and comprehensive exposition of the principles and practices of insurance. Weskett's work is practically a comprehensive dictionary of insurance containing a concise enumeration of all the terms which were used at the time, and a full exposition of the practices and usages of every branch of insurance then known and understood. As an outline of the whole philosophy, science and law of insurance, it has not had its counterpart in any subsequent treatise on the subject. In 1781 de Parcieux published at Paris, his treatise on annuities. As we have previously mentioned, John Nicholas Tetens published in two parts, his introduction to the calculation of life contingencies in 1786.

In 1792 the Universal Tontine was organized in Philadelphia. It was contemplated, no doubt, at that time to transact business in all states then constituting the Federal Union. The originators of this plan included citizens of Philadelphia and Boston. The scheme was based upon the idea of the Boston Tontine Association established in 1791. This latter association failed in its original intent and ultimately became the state bank. A similar proposal in New York City also came to naught, but out of the Universal Tontine in Philadelphia, there developed the Insurance Company of North America.

In 1798 the Itinerant Methodist Preachers Annuity Society was founded in London.

We have now brought this record to the close of the 18th century and have reached the point where the transaction of annuity business was largely taken over by incorporated life insurance institutions whose calculations were based upon the fairly substantial basis of observed mortality experience. Insurance supervision by the states was established in principle (Massachusetts, 1799). It would extend this article too much to continue with a full discussion of the development of annuities

in the 19th century or to the time the usury laws were repealed in England—1854. The material shown is, possibly, a third of the amount of original data collected. Nothing has been said of the *montes pietatis*, only a scrap of the early history of vital statistics has been given, and the treatment of the legal and external economic aspects of the annuity has been much abridged. There is much that could be stated on nineteenth century annuity practice from the works of Charles Ansell, the father of actuarial science in Great Britain during the 19th century, and from the writings of Charles Babbage, Joshua Milne, Francis Bailey, Griffith Davies, David Jones, the Finlaisons, Augustus DeMorgan, J. W. Lubbock, Cornelius Walford, Jenkin Jones, William Farr, Samuel Brown, and the others who held aloft the torch that guided life insurance through several perilous eras during that century. Enough has been given, however, to show that the annuity has a record of possibly not less than 3,500 years of service. It may be feasible in a later essay to take up the exceedingly interesting career of the annuity during the 19th century, especially to consider its decline after 1854, and to suggest from the entire review of the annuity, certain amendments which could be made in current annuity and "rent-charge" practice. And by "current annuity and rent-charge practice" is meant any of the activities of investment banking institutions, insurance corporations and Courts having to do with periodical payments secured against legal persons, or against land and other property.

Except in a few of the companies, to-day the annuity is the step-child of the insurance business. Much can be done, and perhaps much will be done, to revise plans of annuity contracts to meet the needs of the public in the future. Estate economists, persons interested in trusteed life insurance, the courts seeking for the the best disposition of lump sum settlements, and moneyed persons may find the certain yield of the life annuity more attractive than the slowly falling yield on the fixed rate securities which will be available to private investors in the future. Something could be said also of certain academic proposals at the present time for the drafting of an annuity plan providing for payments constant in purchasing value.

One of the most important topics which could be discussed is the rise of that form of annuity which is called a "pension."

This would take us into the development of early pension plans in England, the utilization of the idea in the organization of social insurance in Germany, the service of the annuity in France, the development of municipal and industrial pensions in the United States, and into other fields which fall outside the range of the present article.

I trust that I have given enough information to engage the further interest of our students in historical inquiry in the insurance field, and in the discovery of practices long since used and forgotten. These, when resurrected and stated in terms of today's insurance business could be applied with benefit over the entire field of personal insurance. The history of the annuity shows a succession of waves of interest and of working efficiency, the duration of which has depended largely upon the state of external economic and political conditions and upon the growth and decline of various philosophies of jurisprudence. Possibly in this historical review and in others which should be made, there are ideas which can again be applied in this current age characterized by a highly developed social jurisprudence, an advanced state of industrial organization, and a Renaissance of interest in the economic principles and practices which affect the business of insurance.

For much of the material in this article I am indebted to the works of Walford, Heinrich Braun, C. F. Trenerry, Vermeersch, Farren, Francis, Endemann, Ehrenberg, Jack, Hoffman, Gram, Grosse, Low and many others, whose writings I was privileged to examine during the long period in which the preparatory work on this paper was conducted. A short bibliography follows.

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