#### CATALOGUE OF AN EXHIBITION

# ILLUSTRATING THE HISTORY OF ACTUARIAL SCIENCE IN THE UNITED KINGDOM

in the Library of the Institute of Actuaries at Staple Inn from Monday, 2 July to Wednesday, 4 July 1973

1 John Graunt (1620–1674)

"Natural and Political Observations upon the Bills of Mortality"
1st edit., 1662

Institute Library

This was the book which laid the foundation of "political arithmetic," i.e. demography. It contained a rudimentary life table derived from the statistics of burials.

### 2 Edmond Halley (1665-1742)

- 2.1. "An estimate of the degrees of the mortality of mankind drawn from curious tables of the births and funerals at the city of Breslau"

  Philos. Trans., 1693
- 2.2. "Some further observations in the Breslau bills of mortality"
  Philos. Trans., 1693

Royal Society

The well-known astonomer also produced the first life table computed from statistics. He used the data for Breslau for the years 1687-1691, which had been sent to him by Caspar Neumann, a German clergyman and scientist.

# 3 Abraham de Moivre (1667-1754)

3.1. "The doctrine of chances"

1718

3.2. "Annuities upon lives; also of reversions"

1725

3.3. "Miscellanea analytica de seriebus et quadraturis"

quadraturis" 1730 Royal Society, Institute Library

Moivre fled to England at the time of the revocation of the Edict of Nantes in 1685. He was a mathematician who made a name for himself in the flowering of mathematics in the age of Newton, whose friend he was. His books gave the first systematic treatment, in English, of probability and of annuities upon lives. The solutions of complicated problems concerning annuities were mainly based on the hypothesis of equal decrements. Statistics of mortality were scanty; the hypothesis fitted Halley's table sufficiently well at the ages required for the valuation of annuities. James Dodson was one of his pupils.

# 4 William Jones (1673-1749)

"The Practice of Interest"

MS.

Institute Library

William Jones, the mathematician and friend of Newton, produced this mathematical analysis of compound interest problems, including an approximate formula for the rate of interest in an annuity-certain. The work was circulated in

manuscript form, in copper-plate writing. The rules for the various cases were printed in the prefaces to Gardiner's *Table of Logarithms* and Dodson's *Anti-Logarithms*, both published in 1742. The work was mentioned in a letter dated 13 December 1770, by John Robertson, FRS, to the Royal Society, which was printed by Maseres in *Scriptores Logarithmici*, Vol. V.

### 5 Thomas Bayes (c. 1701-1761)

5.1. "An essay towards solving a problem in the doctrine of chances"
Philos. Trans., 1763

#### 5.2. Mathematical notebook

MS.

Royal Society, The Equitable Life

The essay discusses the inverse probability theorem, which is named after Bayes. When Bayes died his papers were sent to Richard Price, who found the essay among them and prepared it for publication. Bayes's handwriting was distinctive and there is little doubt that the mathematical notebook was his own.

## 6 Thomas Simpson (1710-1761)

"The doctrine of annuities and reversions"

1742

Institute Library

Simpson was dissatisfied with the hypothesis of equal decrements and gave the methods of calculating annuities direct from observations. The bills of mortality for London had been tabulated in age groups since 1728. Simpson used the bills for the ten years, 1728–1737, as the basis for his mortality table. Above age 25 the table was the same as that computed by John Smart, A table of mortality deduced from the London Bills . . . (1738). Simpson adjusted the figures for ages under 25 to allow for the flux of population.

## 7 James Dodson (c. 1710–1757)

7.1. "The anti-logarithmic Canon"

1742

MS.

7.2. "Observations on the past growth and present state of the City of London" by Corbyn Morris. 1751, 2nd ed., 1757

(The statistics which Dodson used and on which life assurance was founded.)

7.3. First lecture on insurances

MS. written in 1755 or 1756

7.4. Monetary tables . . .7.5. "The Mathematical Repository"

3 vols., 1747-1755

7.6. Photostat copy of will

The Equitable Life, Institute Library

The anti-logarithmic Canon was a classic work. The "Hand and Pen" referred to on the title page was the sign of a writing-master. It seems likely that Dodson supported himself in this way and in the teaching of accounts while he was preparing his book. The First lecture on insurances was a treatise which gave the first exposition of the theory of life assurance. The statistics used were the London bills of mortality for the twenty-three years, 1728-1750. The monetary tables calculated with interest

at 3% p.a. were those adopted by the Equitable Life Assurance Society at its inception in 1762. The main part of the "First lecture" is reprinted in the *Proceedings* of the Centenary Assembly of the Institute of Actuaries, Vol. 111, pp. 374-80. Dodson's will shows that he left little more than his expectation in the charter fund of the Society founded upon his work.

## 8 Richard Price, D.D. (1723-1791)

8.1. Correspondence with John Edwards

(copies of letters from 1768–1771)

8.2. "Observations on the expectations of lives . . ."

Philos. Trans., 1769

- 8.3. "Observations on the proper method of calculating the values of reversions depending on survivorship" Philos. Trans., 1770
- 8.4. "Observations on reversionary payments . . ." 1st. edit., 1771
- 8.5. "Observations on the proper method of keeping the accounts and determining from year to year the state of the Society"

MS. written 1774

8.6. "General explanations and remarks" concerning proposals for the redemption of the national debt MS. written 1784

8.7. Portrait by Benjamin West

The Equitable Life, Royal Society, Institute Library

Richard Price was a presbyterian (unitarian) minister who was a prominent supporter of many causes. He was a friend of Benjamin Franklin and other Americans and helped Yale University in its early days. During the War of Independence, he published a book supporting the Americans. He was President of the Revolution Society which commemorated the revolution of 1688. He was a friend of Necker and published a sermon welcoming the French revolution, which drew forth the retort by Burke, "Reflections on the Revolution in France".

Many annuity and other societies had been started on an insufficient foundation. Price showed the principles on which such societies should be based and the real cost of the benefits being promised. He was often consulted by the Equitable Life Assurance Society in its early days. After his nephew, William Morgan, had been appointed Actuary of the Society, Price was frequently seen riding his horse through the City streets to the Society's house in Chatham Place, by Blackfriars Bridge.

Price wrote much about public finance, because he feared the mounting government debt. He proposed the establishment of a sinking fund, a proposal which was afterwards adopted by Pitt (the younger) without acknowledgment to him. A copy of the portrait by Benjamin West is hanging in the Reading Room. It

was given by Arthur Cadogan Vachell, a great grandson of William Morgan.

## 9 William Morgan (1750-1833)

- 9.1. "The doctrine of annuities and assurances on lives and survivorships" 1779
- 9.2. Computation of premiums for life assurance on the basis of the Northampton table of mortality

  MS.

- 9.3. Valuation (individually) of the assurance contracts in force in 1786 MS.
- 9.4. Yearly computation of expected deaths and accounts showing the state of the Equitable Life Assurance Society according to the plan suggested by Richard Price

  MS.
- 9.5. "On the probabilities of survivorships between two persons of any given ages, and the method of determining the values of reversions depending on those survivorships" Philos. Trans., 1788-1794
- 9.6. Nine addresses to the General Court of the Equitable Society covering the years 1793 to 1830
- 9.7. Portrait by Sir Thomas Lawrence

The Equitable Life

William Morgan was born in Bridgend, Glamorganshire, and came to London for a medical training at Guy's Hospital. He was appointed Assistant Actuary of the Equitable Life Assurance Society in 1774 and was elected Actuary in the following year, after the untimely death of John Pocock. In an unparalleled period of service of 56 years until his retirement in 1830 at the age of 80 years, he built up the business of life assurance and laid the foundations of the actuarial profession. He may justly be regarded as the father of the profession. He was consulted when other life offices were being formed and had a considerable practice in giving advice on actuarial problems. In course of time the name of Actuary became attached to the profession principally because of his attainments. His work on survivorships gained him the award of the Copley medal by the Royal Society in 1789. A copy of the portrait by Lawrence is hanging in the Hall. It was given by Arthur Cadogan Vachell, a great grandson of William Morgan.

Cadogan vachen, a great grandson of william Moi

#### 10 George Barrett (c. 1752-1821)

10.1. Correspondence with Francis Baily

MS.

10.2. Calculations based on Swedish, Northampton and Deparcieux's observations

MS., 7 vols.

10.3. Tables based on Swedish mortality

MS.

Institute Library

The first commutation columns in Great Britain. They were offered to various assurance offices for publication by subscription and to the Royal Society, but they were never published. William Dale had published the method in England in 1772 and J. N. Tetens in Leipzig in 1785. Barrett made the discovery independently and to Barrett should go the credit for seeing the possibility opened up by the new method. The London Life Association, Ltd., bought the manuscripts in 1827 and presented them to the Institute in 1884. The Swedish tables were presented to the Institute by E. Docker in 1890. Barrett was by nature a calculator and appears to have been unsuccessful as a practising actuary.

## 11 Francis Baily (1774–1844)

11.1. Tables for the purchasing and renewing of leases

MS.

11.2. The doctrine of life annuities and assurances analytically investigated and explained MS.

11.3. The same . . . author's printed copy

1813

11.4. Reports dated April-May 1810 relative to the premium basis, etc., for the Sun Life Assurance Society MS.

The Sun Life, Institute Library

Baily was a member of the Stock Exchange and one of the founders of the Royal Astronomical Society. As such, his portrait appeared with the two Herschels on a postage stamp issued on 1 April 1970 to commemorate the 150th anniversary of that society. He used his influence as a Fellow of the Royal Society to support Barrett's efforts to secure the publication of the commutation columns. Baily gave specimens of them in his "Doctrine". Spurious editions of that book were produced, dated 1810 and 1813, the latter about 1850.

The National Portrait Gallery has a portrait of Francis Baily in a group of men in science.

## 12 Joshua Milne (1776–1851)

"A treatise on the valuation of annuities and assurances on lives and survivorships, on the construction of tables of mortality, and on the probabilities and expectation of life" 2 vols., 1815

Institute Library

Milne was the first Actuary of the Sun Life Assurance Society. He constructed the Carlisle table of mortality for its use. Like Francis Baily, he was greatly interested in astronomy. The "Treatise" was, perhaps, the best of the early works on life assurance.

## 13 **Benjamin Gompertz** (1779–1865)

- 13.1. "Sketch of an analysis and notation applicable to the value of life contingencies"

  Philos. Trans., 1820
- 13.2. "On the nature of the functions expressive of the laws of human mortality, and on a new method of determining the value of the contingencies"

  Philos. Trans., 1825
- 13.3. Letters bound with reprinted papers

MS.

- 13.4. Makeham's modification "On the law of mortality . . ." Journal of the Institute of Actuaries, vol. 8, p. 301
- 13.5. Portrait in water colour

Sun Alliance and London, Royal Society, Institute Library

The paper of 1825 put forward the law of mortality known by Gompertz's name. Makeham always described his law as being a modification of Gompertz's Law. Gompertz was the chief officer and first Actuary of the Alliance.

## 14 John Finlaison (1783–1860)

14.1. Report of 1829 relating to the experience among tontines and government life annuitants

1829

- 14.2. A morning's work on the Royal Exchange experience, 1721–1830 MS.
- 14.3. Experience of Government life annuitants, 8 vols.

MS.

14.4 Bust, by Mazzoni (on dais in Hall)

The Equitable Life, Guardian Royal Exchange, Institute Library Finlaison was the first President of the Institute of Actuaries. He was Keeper of the Admiralty Records 1809–1822 and Actuary of the National Debt 1822–1851. He compiled the first Navy List in 1814. His report in 1829 led to the Northampton table being superseded by Finlaison's table for the sale of annuities by the Government. The manuscripts relate to the later experience of government life annuitants. One day in 1831 Finlaison called on Augustus de Morgan for breakfast, who happened to have temporarily in his possession the experience of the Royal Exchange Assurance Corporation. Finlaison at once sat down and, before breakfast, produced the table exhibited.

#### 15 Griffith Davies (1788–1855)

- 15.1. Values of assurances on the basis of the Northampton table of mortality and interest at 3% p.a. computed in 1820.
- 15.2. "Tables of life contingencies"
- 15.3. "An investigation of the bases for calculating life contingencies, of the profits on life assurances, and of an equitable method of apportioning these profits by way of bonuses among those assurers"

24 reports, 1822-1831

Guardian Royal Exchange, Guildhall Library, Institute Library

Davies was Welsh and born of poor parents. Coming to London, he became a teacher of mathematics. He was the first Actuary (1822–1854) of the Guardian Assurance Company. He was also Actuary of the Reversionary Interest Society from 1823.

The tables of 1825 gave the first full commutation columns published in Great Britain. Davies computed his table of the mortality experience of the Equitable by reference to the Northampton table, using the proportions of actual to expected deaths given by William Morgan.

## 16 Charles Babbage (1792-1871)

"Comparative view of the various institutions for the assurance of lives" 1826

Institute Library

Charles Babbage, who is justly renowned as a pioneer of computers, also produced this analysis of life-office practice which is the best survey of life assurance in his time.

#### 17 The Actuaries' Club

- 17.1. First volume of minutes
- 17.2. Memorandum by J. J. Downes on the early history
- 17.3. Annals of the Actuaries' Club

- 17.4. "Early history, the Club, the Institute, the Institute Club, the Association," by C. D. Higham

  1929
- 17.5. Albums of portraits of members of the club

Actuaries' Club, Institute Library

#### 18 Institute of Actuaries—I

- 18.1. Minutes of meetings preparatory to the formation of the Institute (resolution of 8 July 1848)

  MS.
- 18.2. Printed papers and cuttings, collected by Peter Hardy 1848
- 18.3. "A statement of facts connected with an anonymous circular and the proceedings at certain meetings of actuaries and others officially connected with life assurance companies" by E. Ryley 1848

#### 19 Institute of Actuaries—II

- 19.1. First volume of minutes of the Council, with names on the fly-leaf
- 19.2. Constitution and laws, including list of members and library catalogue 1848, 1850 and 1851
- 19.3. The first sessional paper delivered to the Institute in 1849, "A paper on the construction of logarithms" by Griffith Davies
- 19.4. Journal of the Institute of Actuaries (bound in the set originally belonging to J. A. Higham)
- 19.5. Albums of portraits of the Presidents of the Institute
- 19.6. "The Insurance Cyclopedia", by Cornelius Walford 1871-1878 (with an interesting dedication to the Institute of Actuaries and the Faculty of Actuaries)

#### 20 Institute of Actuaries—III

- 20.1. The Charter of 1884, and the original Byelaws bound with it. Supplemental charter of 1958
- 20.2. Staple Inn, letter dated 9 December 1886 from the Prudential Assurance Co. Ltd., offering the tenancy
- 20.3. The first Institute text-book
- "On life contingencies, including life annuities and reversions" by George King 1887
- A signed and dated photograph of George King is with the book.
- 20.4. Composite photograph of Fellows of the Institute in 1898, with key

- 20.5. John Napier (1550–1617), Baron of Merchiston, statuette presented by the Faculty of Actuaries to the National Portrait Gallery in 1898—replica originally presented to the Institute in 1899, replaced in 1946.
- 20.6. Thomas Bond Sprague—marble bust (1902) by MacGillivray
- 20.7. Sir George Francis Hardy, K.C.B., bronze bust (1916) by Gilbert Bayes
- 20.8. War memorial tablet, 1914-1919 and Roll of Honour, 1939-1945
- 20.9. Grant of Arms
- 20.10. Presidential badge (replica) presented in 1955 by the then nine Past Presidents

#### 21 Institute of Actuaries—IV

- 21.1. Gold medal (1927) presented to George King—plaster casts of obverse and reverse, and two-toned bronze replica of the medal, which was produced by the Royal Mint
- 21.2. Gold medal (1929) by Gilbert Bayes, presented to George James Lidstone, LL.D., jointly by the Institute and the Faculty of Actuaries

  Plaster cast

A portrait of Lidstone by Frank Eastman is hanging on the staircase.

- 21.3. Gold medal (1937) by Gilbert Bayes, presented to Sir William Palin Elderton, K.B.E., jointly by the Institute and the Faculty of Actuaries
- 21.4. Gold medals awarded under the regulations of 1963.
- 1964, Wilfred Perks
- 1964, William Phillips, O.B.E.
- 1968, Frank Mitchell Redington
- 21.5. Silver medals awarded under the regulations of 1963.
- 1966, Robert James Kirton, C.B.E.
- 1966, Maurice Edward Ogborn
- 1967, Herbert Weston Haycocks
- 1972, Robert Eric Beard, O.B.E.
- 21.6. Binary Calculator

Science Museum

An illuminated book which records all the awards of medals and prizes is displayed in the Council Chamber. Phillips's medal is not available for exhibition, but the binary calculator he displayed (on 27 January 1936) at the Institute has been lent for this exhibition.

#### 22 Institute of Actuaries-V

Gifts displayed in the showcase in the Council Chamber

- 22.1. Gold medal originally presented in 1908 to T. N. Thiele by the Danish Actuarial Society on the seventieth birthday of their founder, and presented by them to the Institute in 1948
- 22.2. Silver tankard, presented in 1972\* by the Norwegian Actuarial Society
- 22.3. Silver salver, presented in 1948 by the Portuguese Institute of Actuaries
- 22.4. Plaque, presented in 1948 by the Swedish Actuarial Society
- 22.5. Silver ash trays, presented in 1972\* by the Scandinavians who had been students at the Institute under the special scheme
- 22.6. Carved ivory figure of Saraswati, the goddess of learning in Indian mythology, presented in 1955 by the Actuarial Society of India
- 22.7. Silver candlesticks made in 1714 and 1719 bearing the insignia of Staple Inn, lent to the Institute in 1972 by the Prudential Assurance Co. Ltd.
- 22.8. Staple Inn plate, presented in 1955 by F. A. A. Menzler
- 22.9. Karl Pearson silver spoons, presented in 1962 by Lady Elderton
- 22.10. Silver lectern, onyx inkstand and gold letter opener, presented in 1972 by Mrs. A. G. Simons in memory of her husband

The lectern is on the Council table. There is a complete record of the gifts to the Institute in the book displayed in the Council Chamber.

#### 23 Institute of Actuaries—VI

Gifts displayed in the Library and Reading Room

- 23.1. Memoirs by Leonard Euler, and an illuminated address, presented in 1948 by the Swiss Association of Actuaries
- 23.2. Etchings and drawings by Rembrandt, presented in 1969 by the Actuarieel Genootschap
- 23.3. Delft tile representing Johann de Witt (1625–1672), presented in 1948 by the Actuarieel Genootschap
- 23.4. Carved rosewood table, presented in 1955 by members of the Actuaries Club (Madras)
- 23.5. Portrait of an unknown mathematician of the seventeenth century, presented in 1950 by G. S. N. Carter

<sup>\*</sup> To replace that presented in 1948 to celebrate the Institute's centenary and stolen in 1971.

23.6. Fraternal greetings by members of the Actuarial Society of America and the American Institute of Actuaries on 8 November 1945

### 24 Staple Inn Hall

The earliest of the stained glass appears to be in the second and third windows in the south wall. The lower middle panels are made up of fragments which would have come from the first Hall on the site. The merchant's mark is interesting; it could have been the mark of a woolmonger who was connected with the Hall.

The window opposite in the north wall comprises four panels from the time of the building of the Hall in 1580-1581. Nicholas Brokus (or Brooke) was Principal. The second panel is of the arms of Richard Champion, whose arms also appear on one of the corbels of the hammerbeam roof.

The first window south contains the glass from the early years of the newly built Hall. The three royal panels contain the arms of Elizabeth I, James I and Charles I (when Prince of Wales).

The oriel window in the north wall contains glass in a series from the eighteenth and nineteenth centuries. The two panels with the arms of Elizabeth I and the wool-pack insignia appear to be contemporary with the first of this series.

The arms of the Institute of Actuaries appear in the third window south, a gift by John Spencer.

On the dais stands the council table, presented by Lidstone to replace the one given by Phelps which was lost with the Hall. The silver pitcher and tray which stand on the table were presented in 1972\* by members of the Society of Actuaries. The mace, though dated 1816, refers to the Ancient Society of Staple Inn, 1553. To one side is the Levine lectern.

The roof was reconstructed to the original design. One truss (at the gallery end of the Hall) was made from the original timber and the remainder from old timber to match.

The exhibition includes six water colours of Staple Inn in 1882 by J. Crowther (lent by Guildhall Library), an oil painting of Staple Inn in 1887 by Godfrey Young (lent by the Prudential Assurance Co. Ltd.), and various other pictures and photographs of Staple Inn.

\* To replace those presented in 1948 to celebrate the Institute's centenary and stolen in 1971.

M. E. OGBORN