# The Support of Research in Medical and Allied Fields for the Period 1946 through 1951

Stella Leche Deignan and Esther Miller

*Medical Sciences Information Exchange, Division of Medical Sciences, National Research Council, Washington, D. C.*

*Foreword*: One of the difficult tasks in human affairs is the establishment of joint enterprises designed to serve a number of groups. This is particularly true within the federal government, where the intricacy of the relationships within agencies makes interagency cooperative endeavors even more difficult. The Medical Sciences Information Exchange is such a cooperative endeavor. It was established in July 1950 within the Division of Medical Sciences, National Research Council, by six federal agencies, the Department of the Army, the Department of the Air Force, the Department of the Navy, the Atomic Energy Commission, the Public Health Service, and the Veterans Administration, which jointly support it and maintain it as a clearinghouse for information on grant and contract support in the medical and allied fields.

The Policy Committee, Medical Sciences Information Exchange, composed of the heads of the grant or contract divisions of the six agencies supporting the exchange, recognizes the contribution of the many private philanthropic organizations whose cooperation in the exchange has made this report possible. The report is unique because it is a survey of a broad field of research—medical and allied fields. The cost of this research measured in dollars is great, and the number of individual projects is large. The maintenance of the project data on a current basis has resulted in substantial savings; it is hoped that its periodic summarization will effect additional economies in research administration.

The committee believes this report is an indication of the success of the cooperative effort. The daily use of the exchange by investigators throughout the country and by granting agencies is gratifying. With the publication of this report the exchange appears to have passed beyond the experimental stage. Its success breeds a hope that the procedure can be repeated in other fields of science.

THE POLICY COMMITTEE
*Medical Sciences Information Exchange*

THIS REPORT, comprising an analysis of 12,923 research grants registered with the Medical Sciences Information Exchange during the period 1946–51, is based on research grants and contracts awarded by government and by the larger public and private foundations. We present the report as an answer to the many requests for information that are received by the exchange, and in the belief that it will illustrate the value of a central clearinghouse and thus stimulate additional participation in the exchange.

As a preface to the analysis, certain limitations of the data should be defined. Few awards made by industry, local foundations, or funds established solely for individual universities have been included. The data from government are, perhaps, more extensive than those from private agencies because of the completeness of records of Public Health Service grants and to the fact that awards made by public and private foundations may not comprise the full programs of these agencies. However, information on contracts made through government agencies other than the Public Health Service is likewise incomplete, with the result that a balance between the government and private sources of funds is approached.

The year 1946 has been chosen as the first year of the record because it represents a period following the end of the wartime support of medical research through the Office of Scientific Research and Development and the beginning of expanded government support of research on what was believed to be a peacetime basis. As an additional government or private agency began cooperation or fuller participation with the exchange, efforts were made to secure information on awards initiated as far back as the government fiscal year 1946, beginning July 1, 1945. There were some projects supported by private agencies during this period, the initial awards for which were made in earlier years and which were not, therefore, registered with the exchange. Any attempt to make our data complete for the period would have required surveys in such volume, and delays of such length, as to outweigh the value of the additional information secured. Our records for 1946 are, therefore, somewhat incomplete; furthermore, data for 1951 are limited because the material was compiled in the spring before the close of the fiscal year. Actually, the most complete year of the record is the fiscal year 1950. More than 500 additional grants registered with the exchange have been eliminated from this report because of a lack of information on the amounts awarded.

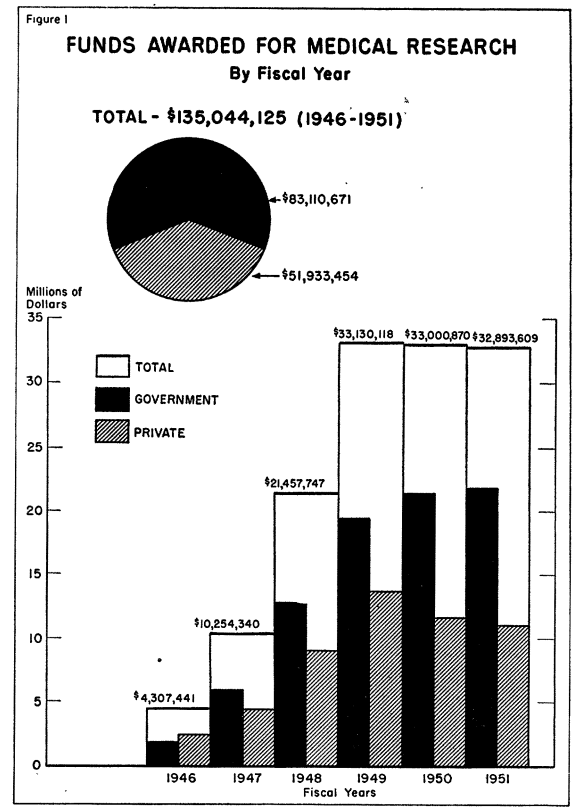
Throughout the report, the term "grant" is employed to mean an amount of money approved for the support of a project for the period of one year and refers to both grants and contracts. "Year" is the governmental fiscal year which begins July 1. "Private" embraces nongovernmental public granting agencies and private foundations.

The material is viewed from the standpoint of

TABLE 1

TOTAL FUNDS AWARDED BY GOVERNMENT AND PRIVATE SOURCES
(1946–51)

| | 1946–51 | | 1946 | | 1947 | | 1948 | | 1949 | | 1950 | | 1951 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts |
| *All agencies* | *12,923* | *135,044,125* | *525* | *4,307,441* | *997* | *10,254,340* | *2065* | *21,457,747* | *2803* | *33,130,118* | *3317* | *33,000,870* | *3216* | *32,893,609* |
| Government | 7216 | 83,110,671 | 131 | 1,871,065 | 416 | 5,807,147 | 1051 | 12,859,975 | 1441 | 19,466,388 | 2052 | 21,320,493 | 2125 | 21,785,603 |
| Private | 5707 | 51,933,454 | 394 | 2,436,376 | 581 | 4,447,193 | 1014 | 8,597,772 | 1362 | 13,663,730 | 1265 | 11,680,377 | 1091 | 11,108,006 |




funds available for medical research during the period covered, separated to distinguish amounts awarded by government and by private sources. The first part of this presentation is concerned with the distribution of these amounts by geographical location and fiscal year, an analysis of the size of grants, the amounts received by individual investigators, and the duration of support of research projects. The second part of the presentation is concerned with the distribution of funds by subject field.

The total funds (as recorded with the exchange) awarded for research in the medical and allied fields are considered first. During the six years from 1946

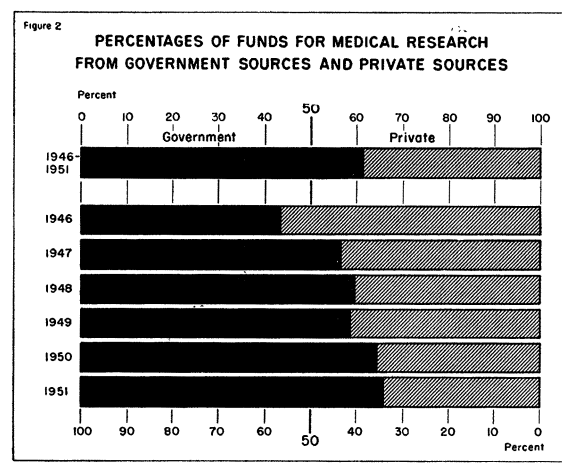
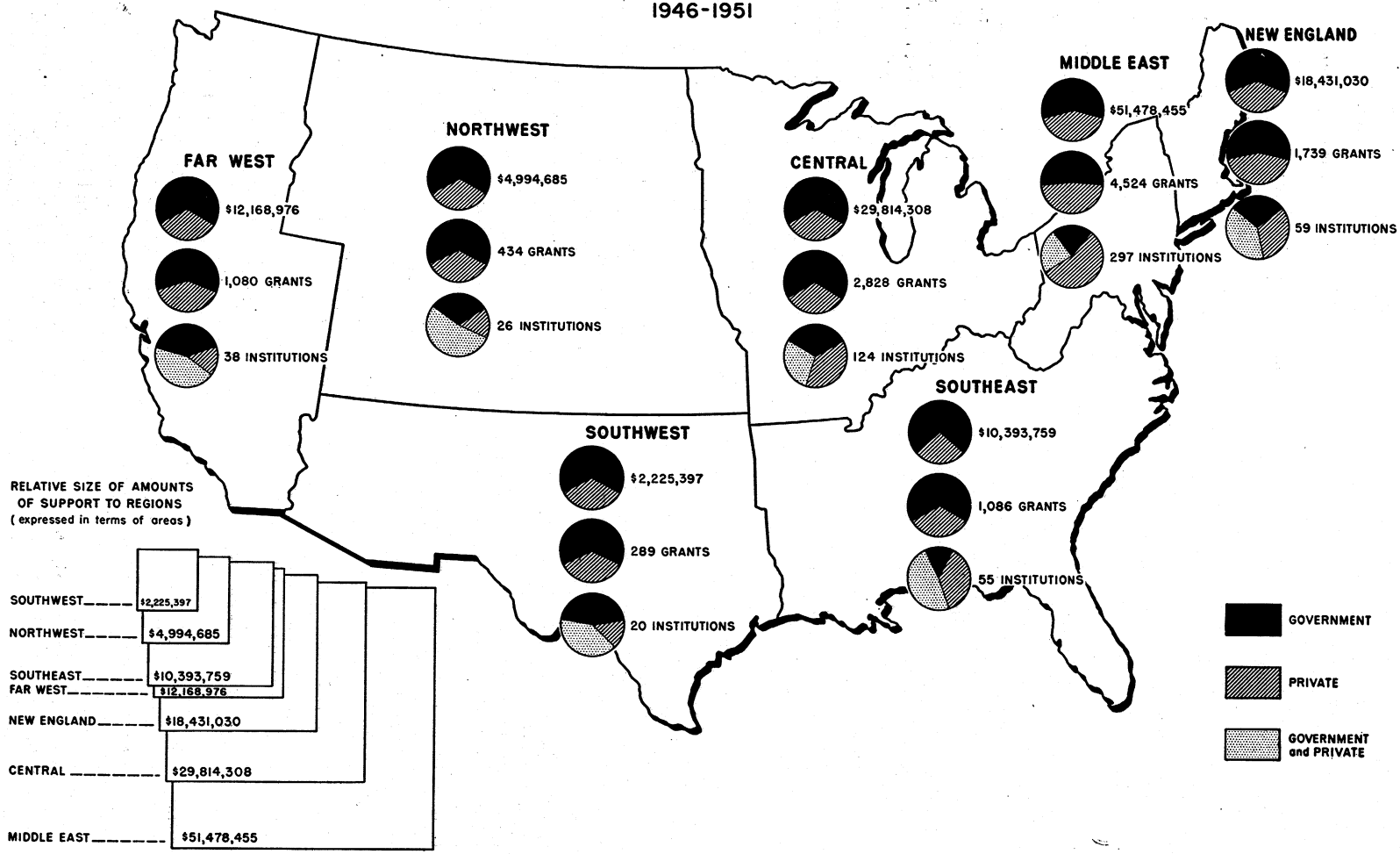


Figure 3

DISTRIBUTION OF FUNDS AND GRANTS BY REGION,
SOURCES OF GRANTS TO INSTITUTIONS WITHIN REGIONS
1946-1951



through 1951, $135,044,125 was awarded through 12,923 grants; $83,110,671, or 61.5%, from government and $51,933,454, or 38.5%, from private sources. Table 1 and Fig. 1 show the amounts by year.

The funds increased from 4 million dollars in 1946 to 33 million in 1949 and have remained at approximately this level. Government support, only 44% in 1946, has steadily increased until, in 1951, it provided nearly 66% of the total support of medical research, as demonstrated in Fig. 2. Funds from private sources, however, increased from 2 million in 1946 to 11 million in 1951, indicating that increasing governmental support of medical research has in no way diminished the efforts of the private foundations.

The disparity of the percentages may not be as great as it seems, since many private agencies are emphasizing the support of "established investigators" rather than research projects. Furthermore, there are indications that, during recent years, private foundations have been responsible for the major support of fellowships and, in the opinion of the authors, little distinction can be made between the support of research through the mechanisms of grants or fellowships. Both contribute to the same objective.

The increase in the support of medical research over this six-year period is clearly less than the figures indicate. Although the funds awarded have increased 800%, the purchasing power of the dollar in research fields has decreased as steadily as its purchasing power in other fields, and interpretation of growing support of medical research must be based upon the increased costs involved.

Fig. 3 presents the distribution of research funds throughout the United States which, for convenience, has been divided into the following six regions:

*New England,* consisting of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont;
*Middle East,* consisting of Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia;
*Southeast,* consisting of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia;
*Southwest,* consisting of Arizona, New Mexico, Oklahoma, Texas;
*Central,* consisting of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin;
*Northwest,* consisting of Colorado, Idaho, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, Wyoming;
*Far West,* consisting of California, Nevada, Oregon, Washington.

In addition to the amount of funds by region, Fig. 3 presents the numbers of institutions and the numbers of grants in each region. Table 2 clearly demonstrates that, whereas both government and private agencies cooperate in the support of some institutions, each source of support contributes to a substantial number of institutions not reached by the other. Of the 619 institutions that have benefited by research grants, only 31% received assistance from both sources, whereas 43% are supported by private sources only, and 26% by government only. The dispersion of grants by private agencies appears somewhat greater than that by government agencies, as grants from the former were made to 457 institutions and from the latter to 354. Private sources, however, have supported a substantially greater number of institutions only in the Middle East and Southeast regions; in all other regions the disparity in numbers of institutions supported by the two sources is negligible.

TABLE 2

REGIONAL DISTRIBUTION OF INSTITUTIONS BY SOURCE OF GRANTS (1946–51)

| Region | No. of institutions | | | |
|---|---|---|---|---|
| | Government sources | Private sources | Both sources | Total |
| Middle East | 63 | 166 | 68 | 297 |
| Central | 41 | 47 | 36 | 124 |
| New England | 17 | 19 | 23 | 59 |
| Far West | 16 | 6 | 16 | 38 |
| Southeast | 8 | 20 | 27 | 55 |
| Northwest | 8 | 4 | 14 | 26 |
| Southwest | 9 | 3 | 8 | 20 |
| TOTALS | 162 | 265 | 192 | 619 |

Regional distribution of funds by year is illustrated in Table 3, with Figs. 4–4*f* showing the percentage of distribution. There are no marked differences in the regional distribution of funds over the six years. The greater numbers of research institutions in the Middle East and Central regions quite naturally draw the greater amount of support to these regions. By far the most pertinent measure of the wisdom of the geographical distribution of research funds is the "research potential" developed by Price and Reynolds (*Am. Scientist,* 37, 578 [1949]) with which the distribution of funds compares favorably.

Recognizing the fallacies inherent in any regional grouping, we have also studied the distribution of funds by state. There has been a steady increase in the number of states receiving grants, from 34 and the District of Columbia in 1946 to 48 and the District of Columbia in 1951.

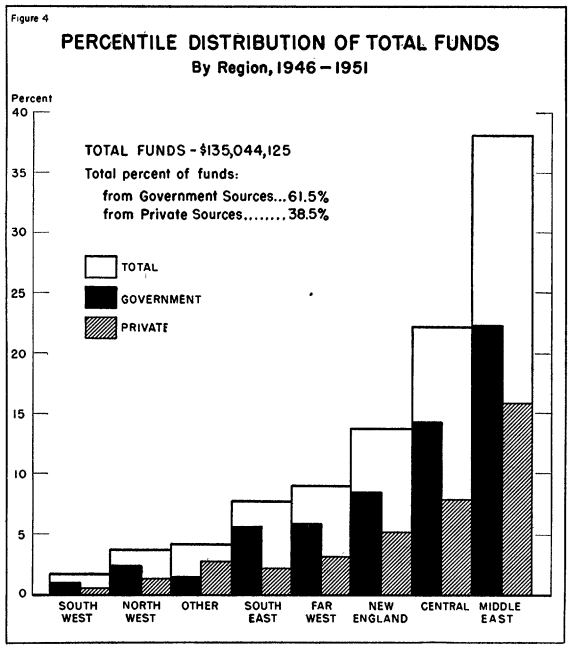
Table 4 illustrates the number of states receiving grants and the sources of these grants during each of the six years. In the first two years private foundations were supporting research in more states than were government agencies, but during the last four years the reverse is true, although the number of states receiving grants from both sources has increased.

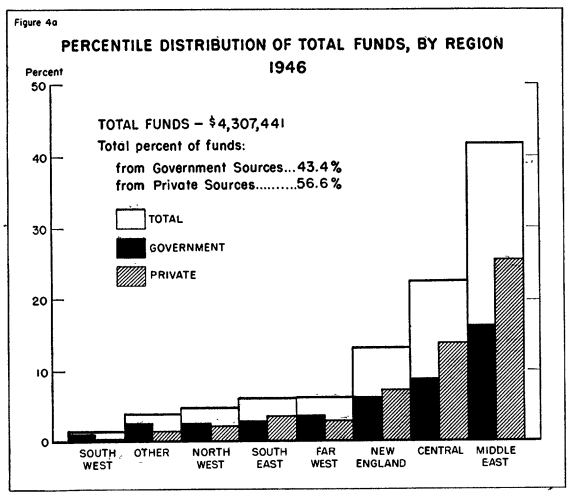
New York has consistently absorbed the greatest amount of funds and has received 20% of the total; Massachusetts is second with 10%; Pennsylvania, California, and Illinois share the third position with 8% each. Table 5 shows that 75% of the total funds have been awarded 11 states.

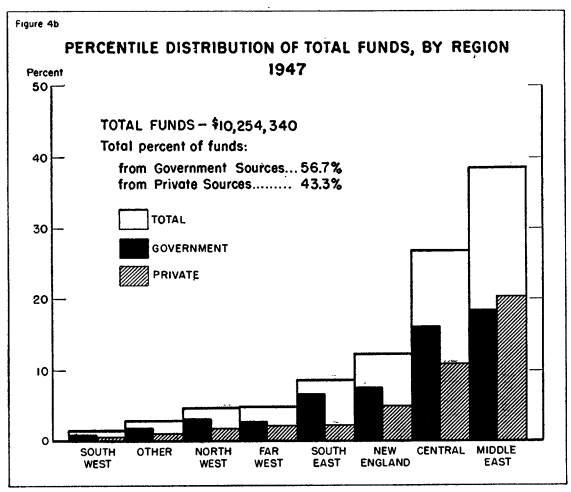
TABLE 3

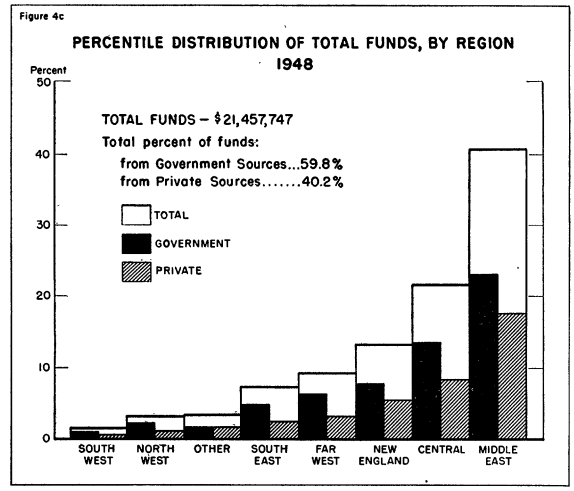
REGIONAL DISTRIBUTION OF TOTAL FUNDS

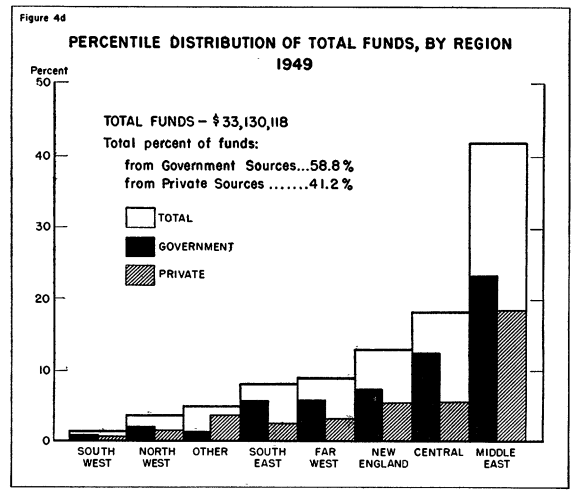
| Regions | 1946–51 | | 1946 | | 1947 | | 1948 | | 1949 | | 1950 | | 1951 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts | No. of grants | Amounts |
| New England totals | *1739* | *18,431,030* | *59* | *569,786* | *134* | *1,284,140* | *273* | *2,823,862* | *362* | *4,337,096* | *449* | *4,526,243* | *462* | *4,889,903* |
| Government | 987 | 11,534,939 | 16 | 265,317 | 58 | 778,424 | 128 | 1,651,274 | 180 | 2,491,113 | 285 | 2,974,097 | 320 | 3,374,714 |
| Private | 752 | 6,896,091 | 43 | 304,469 | 76 | 505,716 | 145 | 1,172,588 | 182 | 1,845,983 | 164 | 1,552,146 | 142 | 1,515,189 |
| Middle East totals | *4524* | *51,478,455* | *250* | *1,808,570* | *403* | *3,983,148* | *759* | *8,702,792* | *983* | *13,925,282* | *1118* | *11,803,919* | *1011* | *11,254,744* |
| Government | 2386 | 30,159,504 | 46 | 699,966 | 132 | 1,891,542 | 375 | 4,930,391 | 475 | 7,757,013 | 680 | 7,316,832 | 678 | 7,563,760 |
| Private | 2138 | 21,318,951 | 204 | 1,108,604 | 271 | 2,091,606 | 384 | 3,772,401 | 508 | 6,168,269 | 438 | 4,487,087 | 333 | 3,690,984 |
| Southeast totals | *1086* | *10,393,759* | *46* | *257,199* | *95* | *848,707* | *163* | *1,555,795* | *212* | *2,615,585* | *281* | *2,646,003* | *289* | *2,470,470* |
| Government | 721 | 7,535,341 | 20 | 112,085 | 49 | 639,991 | 100 | 1,048,395 | 142 | 1,813,353 | 203 | 2,025,915 | 207 | 1,895,602 |
| Private | 365 | 2,858,418 | 26 | 145,114 | 46 | 208,716 | 63 | 507,400 | 70 | 802,232 | 78 | 620,088 | 82 | 574,868 |
| Southwest totals | *289* | *2,225,397* | *7* | *50,961* | *17* | *157,157* | *47* | *332,522* | *59* | *418,044* | *78* | *617,085* | *81* | *649,628* |
| Government | 184 | 1,458,522 | 3 | 41,891 | 9 | 109,895 | 30 | 201,915 | 36 | 229,914 | 55 | 452,996 | 51 | 421,911 |
| Private | 105 | 766,875 | 4 | 9,070 | 8 | 47,262 | 17 | 130,607 | 23 | 188,130 | 23 | 164,089 | 30 | 227,717 |
| Central totals | *2828* | *29,814,308* | *110* | *978,875* | *230* | *2,772,896* | *456* | *4,656,085* | *576* | *6,105,909* | *757* | *7,532,965* | *699* | *7,767,578* |
| Government | 1874 | 19,284,507 | 35 | 380,775 | 114 | 1,647,475 | 286 | 2,875,822 | 382 | 4,203,174 | 536 | 5,149,385 | 521 | 5,027,876 |
| Private | 954 | 10,529,801 | 75 | 598,100 | 116 | 1,125,421 | 170 | 1,780,263 | 194 | 1,902,735 | 221 | 2,383,580 | 178 | 2,739,702 |
| Northwest totals | *434* | *4,994,685* | *13* | *210,124* | *36* | *448,631* | *61* | *658,591* | *90* | *1,145,082* | *109* | *1,251,731* | *125* | *1,280,526* |
| Government | 280 | 3,272,947 | 3 | 112,095 | 20 | 291,298 | 35 | 447,715 | 56 | 672,226 | 75 | 827,581 | 91 | 922,032 |
| Private | 154 | 1,721,738 | 10 | 98,029 | 16 | 157,333 | 26 | 210,876 | 34 | 472,856 | 34 | 424,150 | 34 | 358,494 |
| Far West totals | *1080* | *12,168,976* | *26* | *266,375* | *54* | *492,442* | *159* | *1,994,828* | *241* | *2,981,781* | *286* | *3,220,358* | *314* | *3,213,192* |
| Government | 662 | 8,034,756 | 7 | 148,486 | 28 | 276,467 | 83 | 1,334,971 | 140 | 1,912,718 | 185 | 2,166,670 | 219 | 2,195,444 |
| Private | 418 | 4,134,220 | 19 | 117,889 | 26 | 215,975 | 76 | 659,857 | 101 | 1,069,063 | 101 | 1,053,688 | 95 | 1,017,748 |
| Other countries totals | *943* | *5,537,515* | *14* | *165,551* | *28* | *267,219* | *147* | *733,272* | *280* | *1,601,339* | *239* | *1,402,566* | *235* | *1,367,568* |
| Government | 122 | 1,830,155 | 1 | 110,450 | 6 | 172,055 | 14 | 369,492 | 30 | 386,877 | 33 | 407,017 | 38 | 384,264 |
| Private | 821 | 3,707,360 | 13 | 55,101 | 22 | 95,164 | 133 | 363,780 | 250 | 1,214,462 | 206 | 995,549 | 197 | 983,304 |
| GRAND TOTALS | 12923 | 135,044,125 | 525 | 4,307,441 | 997 | 10,254,340 | 2065 | 21,457,747 | 2803 | 33,130,118 | 3317 | 33,000,870 | 3216 | 32,893,609 |
| Government | 7216 | 83,110,671 | 131 | 1,871,065 | 416 | 5,807,147 | 1051 | 12,859,975 | 1441 | 19,466,388 | 2052 | 21,320,493 | 2125 | 21,785,603 |
| Private | 5707 | 51,933,454 | 394 | 2,436,376 | 581 | 4,447,193 | 1014 | 8,597,772 | 1362 | 13,663,730 | 1265 | 11,680,377 | 1091 | 11,108,006 |

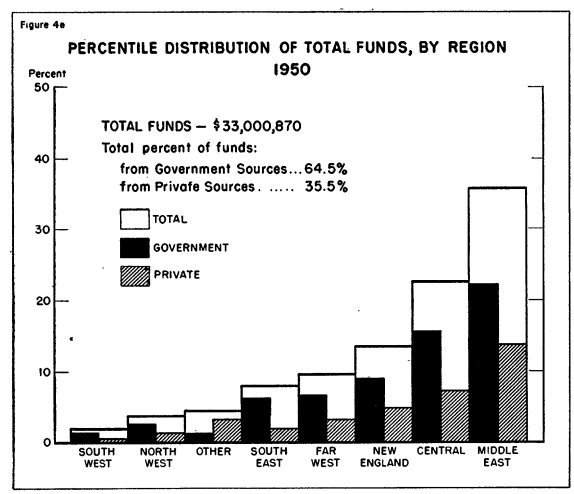


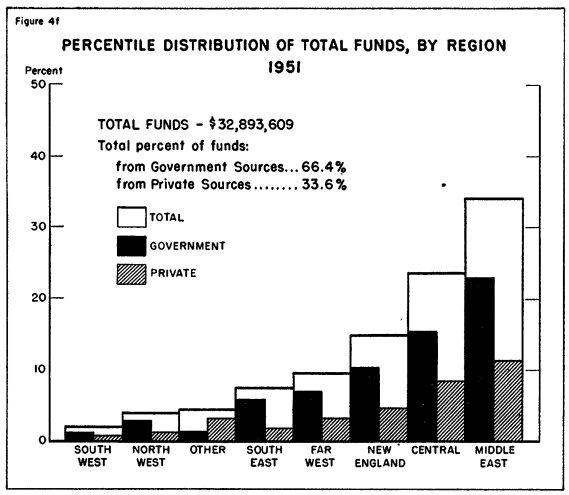




Continuing this analysis, we find that 24 states have been awarded a million dollars or more during the period and, in the aggregate, have received 91% of the total funds. All these states, with the exception




of Kansas, first supported in 1947, have been supported in all years. Table 6 shows the 24 states that have received the greatest amount of funds.

Of the remaining states, four (Maine, New Jersey, Iowa, and Florida) have received between one-half and one million dollars; ten states (Alabama, Oregon, Oklahoma, Vermont, Kentucky, Nebraska, South Carolina, Rhode Island, New Mexico, and Arkansas) have received between $100,000 and $500,000; the rest (Montana, Wyoming, South Dakota, Arizona, Idaho, Mississippi, Delaware, North Dakota, West Virginia, New Hampshire, and Nevada) have received less than $100,000. Of this last group, Wyoming alone has received support through all the years concerned. Support for the others was, with a few exceptions, started in 1949, which may be correlated with the wider state distribution of funds from both sources.

With regard to amount of funds awarded, there has been no appreciable change in the relative positions of the several states in any of the years covered by this report; in short, the percentage distribution of funds among the states for each year is essentially comparable to that for the total period.

From our data it is clear that the majority of research grants, whether from government or private agencies, amount to less than $10,000. This range comprises 68% of all grants, with an even greater number among those of private agencies (77%) than those of government agencies (62%). An additional 20% of all grants fall in the $10,000–$20,000 range, this time with a greater number among grants from government (26%) than from private sources (14%). Fig. 5 shows the distribution of grants by size, first for all grants, then for those of government agencies and private agencies independently. Here it is demonstrated that in all instances large grants ($50,000 and above) represent less than 3% of the total number of grants, and that private sources have awarded slightly more grants in this range than have government sources. Throughout the successive years the figures indicate a diminishing percentage of grants

TABLE 4

NUMBER OF STATES RECEIVING GRANTS

| Fiscal year | Number of states* | | |
|---|---|---|---|
| | Total supported | Government-supported | Private-supported |
| 1946 | 35 | 25 | 34 |
| 1947 | 37 | 29 | 35 |
| 1948 | 40 | 38 | 36 |
| 1949 | 43 | 43 | 38 |
| 1950 | 47 | 47 | 40 |
| 1951 | 49 | 47 | 44 |

* The District of Columbia is counted as a state.

TABLE 5

STATE DISTRIBUTION OF 75% OF TOTAL FUNDS

| State | Percentages | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1946–51 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 |
| New York | 20.24 | 26.50 | 20.76 | 22.10 | 20.23 | 19.29 | 19.02 |
| Massachusetts | 9.85 | 7.62 | 9.38 | 9.31 | 9.12 | 10.27 | 10.90 |
| Pennsylvania | 7.97 | 6.12 | 8.26 | 7.34 | 9.84 | 7.12 | 7.47 |
| California | 7.79 | 5.06 | 4.25 | 8.30 | 7.94 | 8.28 | 8.22 |
| Illinois | 7.61 | 9.03 | 10.93 | 7.93 | 5.62 | 8.51 | 7.23 |
| District of Columbia | 5.08 | 4.37 | 5.05 | 4.71 | 4.65 | 4.71 | 3.20 |
| Maryland | 4.23 | 3.59 | 3.82 | 5.61 | 3.85 | 4.13 | 4.02 |
| Ohio | 3.53 | 2.85 | 4.68 | 2.89 | 3.45 | 3.76 | 3.56 |
| Michigan | 3.51 | 2.64 | 4.05 | 3.28 | 2.34 | 2.94 | 5.36 |
| Connecticut | 2.87 | 3.96 | 2.86 | 2.83 | 3.14 | 2.50 | 2.89 |
| Minnesota | 2.78 | 3.50 | 3.06 | 3.00 | 2.56 | 2.58 | 2.89 |
| TOTAL | 75.46 | 75.24 | 77.10 | 77.30 | 75.74 | 74.09 | 74.76 |

TABLE 6

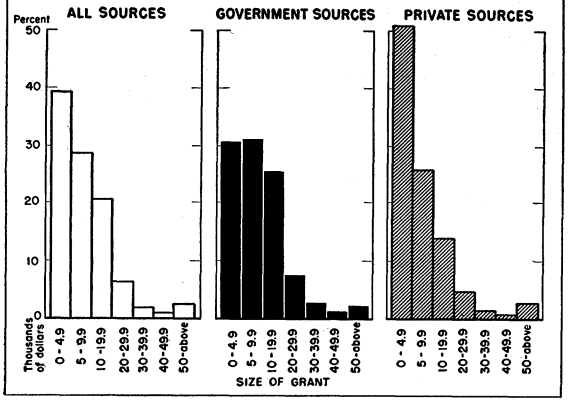
TWENTY-FOUR STATES WITH SUPPORT EXCEEDING 1 MILLION GROUPED IN ORDER OF AMOUNTS AWARDED (1946–51)

| Amounts awarded (in millions) | | | |
|---|---|---|---|
| 10 or more | 2–10 | 1.5–2 | 1–1.5 |
| New York | District of Columbia | Tennessee | Virginia |
| Massachusetts | Maryland | North Carolina | Colorado |
| Pennsylvania | Ohio | Utah | Wisconsin |
| California | Michigan | Texas | Kansas |
| Illinois | Connecticut | | Georgia |
| | Minnesota | | Washington |
| | Missouri | | Indiana |
| | Louisiana | | |

in amounts below $5,000 from both government and private agencies, with a corresponding increase in the $5,000–$20,000 range. This shifting in the size of grants is undoubtedly correlated with the rising costs of all elements of research. It became evident as early as 1947 and progressively mounted until, by 1951, 55% (as compared with 37% in 1946) of all grants from all sources appear in the range between $5,000 and $20,000. Changes have taken place entirely within the lower categories. No variation has been evidenced in the distribution of numbers of grants in amounts

Figure 5

DISTRIBUTION BY SIZE OF 12,923 GRANTS
1946 through 1951




of $20,000 and upward during the successive years.

A survey of the duration of support of projects begun in three of the years covered by this report establishes that over 50% of the projects begun in each of these years have received a minimum of three years' support (Fig. 6). Those projects from the year 1946 offer the longest period of survey and show that 42% of all grants begun in that year were supported for five years or more. On the other hand, there has been a substantial increase in the number of grants that have received only one or two years of support. Whether this increase in short-term duration is the result of investigators' requests or of the policies of granting agencies must remain unanswered because the exchange has no knowledge of refusals to continue support. Certainly the short duration of some projects may be attributed to the fact that granting agencies sometimes prefer a trial period to refusal of assistance of first requests, and reflects the increasing tendency of granting agencies to stimulate research wherever potential exists. These facts may indicate the flexibility of programs which can provide opportunity for research to a number of less well-known investigators. Many of these, undoubtedly, are awarded projects of longer duration at later times.

The exchange has been particularly interested in the number of investigators who have received research funds and has listed, not only principal investigators, but all professional personnel whenever possible. There are 6,634 investigators who have received support during this period. Of these, 5,334, or 80%, have received funds from one source only. A much smaller number—1,119 (17%)—have received funds from two or three sources, and only 181 (3%) have drawn upon four or more sources for support. These data are presented in Fig. 7.

Figure 6

DURATION OF SUPPORT OF RESEARCH GRANTS

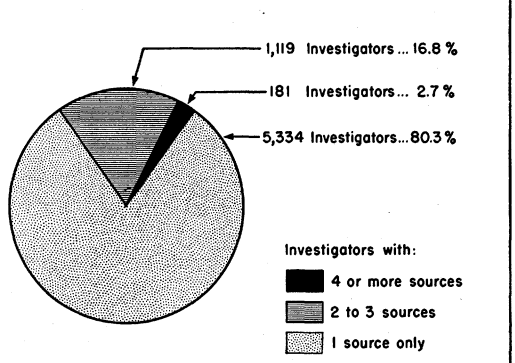
| FIRST YEAR OF SUPPORT | PERCENTAGE OF GRANTS SUPPORTED | | | | | |
|---|---|---|---|---|---|---|
| | 1 YEAR | 2 YEARS | 3 YEARS | 4 YEARS | 5 YEARS | 6 YEARS |
| 1946 - TOTAL | 7 | 10 | 21 | 20 | 19 | 23 |
| Government | 9 | 12 | 10 | 21 | 22 | 26 |
| Private | 6 | 9 | 30 | 18 | 16 | 21 |
| 1948 - TOTAL | 20 | 21 | 19 | 40 | | |
| Government | 22 | 24 | 20 | 34 | | |
| Private | 17 | 17 | 18 | 48 | | |
| 1949 TOTAL | 22 | 24 | 54 | | | |
| Government | 19 | 29 | 52 | | | |
| Private | 26 | 17 | 57 | | | |

Inasmuch as our records consistently list more professional personnel concerned with each project supported by the U. S. Public Health Service than by the other government agencies and by private foundations, one cannot make the obvious deduction that the spread of funds among investigators is greater on the part of government than on the part of private foundations.

It is significant that even though 20% of the investigators do receive support from two or more sources, the routine procedures of the Medical Sciences Information Exchange ensure that each disbursing agency has full knowledge of the support provided by all others and has adequate opportunity, therefore, to prevent any proposed undesirable duplication of research effort. Further, although we cannot, from our records, make an analysis of the number of sources that an investigator has explored in seeking support, it is considered by all granting agencies and by many investigators as most imperative that an applicant have an opportunity to present his proposal to more than one agency, since in many instances an original and worth-while idea not recognized by or within the scope of one group of reviewing consultants will receive enthusiastic support from another.

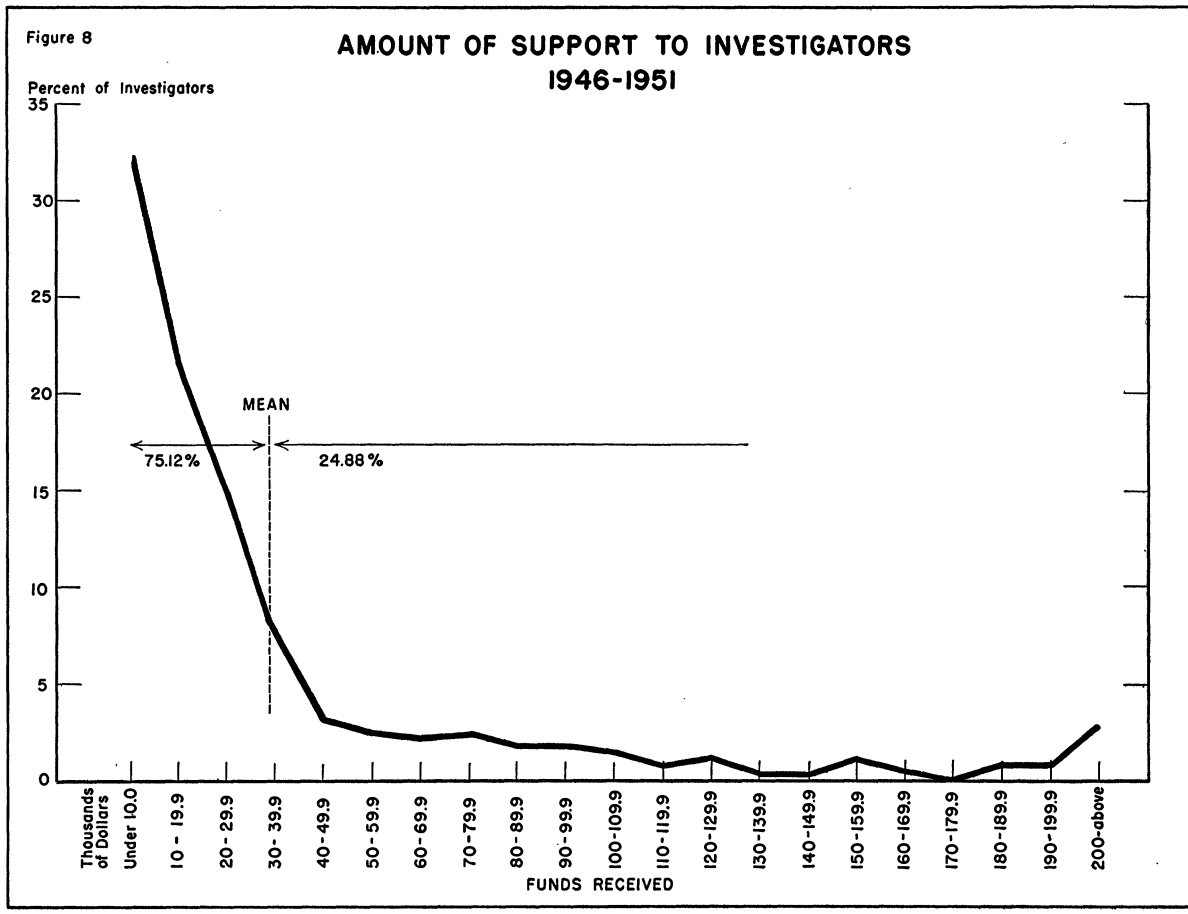
Figure 7

NUMBER OF SOURCES OF SUPPORT OF 6,634 INVESTIGATORS
1946 - 1951




We have been interested in the amount of support received by individual investigators. In discussing these amounts we are concerned only with the cumulative funds over the six-year period, since the funds awarded a man during a single year are meaningless. The data as presented in Fig. 8 show that by far the greatest number of investigators (80%) have been

Figure 8




individually granted less than $50,000 and, indeed, 69% have received less than $30,000. Investigators who have received research support in amounts of more than $200,000 dollars, over the six-year period, constitute less than 3% of all investigators listed and are those men who are heading large research teams or whose work requires the purchase of expensive apparatus. The mean amount was $37,000, the median $16,000, and 75% of all investigators received less than, and only 25% more than, the mean. Certainly, figures such as these indicate that the distribution of research funds among investigators is extremely broad.

An analysis of the distribution of these grants by subject should be preceded by a brief statement of the content of the exchange and the development of its method of indexing. In spite of its name, no rigid definition of medical research has directed the accumulation of subject material. Rather, the content has grown in accordance with the research grant and contract programs of those government agencies supporting the Medical Sciences Information Exchange and which cooperated in the activities of its predecessor, the Office of Exchange of Information, Public Health Service. Construction, teaching aid, and disease control programs of government agencies have never been a part of the exchange.

In developing cooperation with private foundations, the exchange has selected those foundations and programs that are allied to the interests of the supporting agencies, and has, as in the instance of government, excluded rehabilitation and control activities not concerned with investigative research. This flexibility in approach has enabled expansion with the growing interests of the cooperating agencies, permitting the inclusion of research in all fields ancillary to medicine. Consequently, human resources and basic studies in the social sciences have a place in the material. Many people will be gratified to find interdisciplinary relationships taking an increasingly important part in medical research.

The development of a subject index for the day-by-day purposes of the exchange presented particular problems. An exhaustive exploration of existing classifications of medical research resulted in the decision reached many times before, that the only adequate method is one planned to meet specific needs. The index was developed to serve a twofold purpose—to point the way to logical grouping of related research and to furnish a guide to specific detail. In meeting its objectives, it, like the subject matter, grew in accordance with the expansion of the programs of the cooperating agencies. This report will not deal with the detail of the index, but

TABLE 7

PERCENTILE DISTRIBUTION OF FUNDS BY SUBJECT FIELD (Single Category)

| Subject category | 1946–51 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 |
|---|---|---|---|---|---|---|---|
| Cancer | *19.54** | *14.35** | *8.24* | *23.40* | *19.59* | *20.37* | *20.34* |
| Government | 14.75† | 19.08† | 5.72 | 14.74 | 15.74 | 15.70 | 14.98 |
| Private | 27.21‡ | 10.71‡ | 11.52 | 36.36 | 25.08 | 28.89 | 30.87 |
| Infectious Diseases | *17.68* | *22.18* | *28.58* | *18.03* | *16.15* | *15.65* | *17.06* |
| Government | 17.23 | 32.02 | 38.12 | 21.53 | 16.09 | 13.48 | 12.55 |
| Private | 18.41 | 14.62 | 16.13 | 12.78 | 16.24 | 19.61 | 25.91 |
| Cardiovascular System | *8.76* | *6.27* | *8.98* | *6.14* | *6.20* | *10.50* | *11.57* |
| Government | 10.90 | 5.53 | 8.86 | 7.69 | 6.52 | 13.77 | 14.90 |
| Private | 5.34 | 6.84 | 9.14 | 3.83 | 5.73 | 4.52 | 5.04 |
| General Medical Problems | *7.34* | *10.52* | *8.66* | *6.43* | *6.70* | *7.76* | *7.35* |
| Government | 10.04 | 19.06 | 11.91 | 8.88 | 9.55 | 10.29 | 9.63 |
| Private | 3.04 | 3.97 | 4.42 | 2.76 | 2.65 | 3.14 | 2.87 |
| Metabolism & Nutrition | *5.69* | *9.21* | *6.24* | *6.01* | *5.24* | *5.50* | *5.49* |
| Government | 5.07 | 4.97 | 3.56 | 4.87 | 4.78 | 5.40 | 5.55 |
| Private | 6.67 | 12.46 | 9.74 | 7.71 | 5.90 | 5.68 | 5.37 |
| Mental Health | *4.29* | *0.65* | *1.60* | *4.70* | *4.65* | *4.05* | *5.20* |
| Government | 5.38 | — | 1.50 | 6.18 | 6.10 | 4.73 | 6.38 |
| Private | 2.55 | 1.15 | 1.74 | 2.49 | 2.58 | 2.81 | 2.89 |
| Basic Studies | *3.53* | *0.90* | *1.44* | *2.11* | *4.76* | *4.16* | *3.59* |
| Government | 3.57 | — | 1.18 | 1.62 | 4.86 | 4.23 | 3.87 |
| Private | 3.46 | 1.60 | 1.77 | 2.84 | 4.61 | 4.05 | 3.02 |
| Public Health | *3.29* | *3.42* | *4.33* | *4.23* | *2.94* | *3.47* | *2.50* |
| Government | 3.69 | 1.23 | 4.57 | 4.74 | 3.57 | 3.98 | 2.86 |
| Private | 2.64 | 5.10 | 4.01 | 3.47 | 2.03 | 2.52 | 1.80 |
| Nervous System | *2.85* | *2.28* | *2.61* | *2.88* | *3.17* | *2.62* | *2.91* |
| Government | 3.15 | 2.43 | 3.20 | 3.50 | 3.46 | 2.60 | 3.24 |
| Private | 2.39 | 2.16 | 1.84 | 1.96 | 2.75 | 2.65 | 2.26 |
| Blood | *2.62* | *2.02* | *3.50* | *2.04* | *1.68* | *2.00* | *4.36* |
| Government | 3.96 | 4.01 | 5.94 | 3.28 | 2.64 | 2.79 | 6.15 |
| Private | 0.47 | 0.50 | 0.33 | 0.19 | 0.31 | 0.56 | 0.85 |
| Musculoskeletal System | *2.42* | *3.09* | *1.63* | *2.79* | *2.12* | *2.55* | *2.38* |
| Government | 2.94 | 5.70 | 1.26 | 3.58 | 2.47 | 3.13 | 3.02 |
| Private | 1.50 | 1.09 | 2.12 | 1.62 | 1.62 | 1.49 | 1.13 |
| Endocrine System | *2.26* | *1.05* | *0.88* | *1.92* | *2.08* | *2.47* | *3.06* |
| Government | 2.76 | 0.56 | 0.62 | 2.09 | 2.61 | 2.91 | 3.90 |
| Private | 1.47 | 1.43 | 1.21 | 1.68 | 1.32 | 1.65 | 1.39 |
| Problems of Children | *2.04* | *1.85* | *1.57* | *1.86* | *2.01* | *2.24* | *2.15* |
| Government | 1.60 | 0.41 | 0.57 | 1.49 | 1.52 | 1.71 | 2.06 |
| Private | 2.72 | 2.96 | 2.88 | 2.42 | 2.71 | 3.21 | 2.33 |
| Digestive System | *1.43* | *0.06* | *0.54* | *1.58* | *1.61* | *1.70* | *1.35* |
| Government | 2.29 | — | 0.93 | 2.63 | 2.72 | 2.59 | 1.99 |
| Private | 0.05 | 0.10 | 0.02 | — | 0.04 | 0.08 | 0.09 |
| Human Resources | *1.23* | *1.13* | *1.93* | *1.63* | *0.97* | *1.48* | *0.80* |
| Government | 1.79 | 2.60 | 3.18 | 2.61 | 1.54 | 1.95 | 0.93 |
| Private | 0.35 | — | 0.30 | 0.16 | 0.17 | 0.62 | 0.54 |
| Sensory Organs | *1.06* | *0.70* | *1.06* | *0.99* | *0.88* | *1.32* | *1.10* |
| Government | 1.51 | 0.81 | 1.35 | 1.36 | 1.35 | 1.93 | 1.44 |
| Private | 0.35 | 0.62 | 0.67 | 0.43 | 0.21 | 0.22 | 0.42 |
| Urogenital System | *0.88* | *0.06* | *0.70* | *0.63* | *0.62* | *1.03* | *1.32* |
| Government | 1.12 | — | 0.30 | 0.72 | 0.83 | 1.35 | 1.70 |
| Private | 0.50 | 0.10 | 1.23 | 0.50 | 0.32 | 0.45 | 0.57 |
| Ageing | *0.83* | *0.57* | *0.53* | *0.99* | *0.72* | *0.94* | *0.86* |
| Government | 0.91 | — | 0.16 | 1.08 | 0.84 | 1.09 | 0.97 |
| Private | 0.71 | 1.01 | 1.02 | 0.84 | 0.55 | 0.68 | 0.65 |
| Dental Problems | *0.81* | *1.14* | *0.75* | *0.71* | *0.68* | *0.89* | *0.89* |
| Government | 1.17 | 1.01 | 0.97 | 1.10 | 1.04 | 1.23 | 1.31 |
| Private | 0.23 | 1.23 | 0.46 | 0.12 | 0.17 | 0.26 | 0.07 |
| Respiratory System | *0.56* | — | *1.16* | *0.37* | *0.43* | *0.53* | *0.74* |
| Government | 0.79 | — | 2.05 | 0.57 | 0.63 | 0.68 | 0.91 |
| Private | 0.19 | — | — | 0.08 | 0.13 | 0.25 | 0.39 |
| Integumentary System | *0.49* | *0.25* | *0.20* | *0.22* | *0.42* | *1.04* | *0.30* |
| Government | 0.77 | 0.58 | 0.30 | 0.33 | 0.70 | 1.58 | 0.45 |
| Private | 0.04 | — | 0.06 | 0.06 | 0.03 | 0.06 | 0.03 |
| Occupational Diseases | *0.19* | — | *0.48* | *0.27* | *0.13* | *0.21* | *0.11* |
| Government | 0.26 | — | 0.84 | 0.45 | 0.20 | 0.22 | 0.10 |
| Private | 0.07 | — | — | — | 0.03 | 0.18 | 0.14 |
| Other | *10.21* | *18.29* | *14.39* | *10.06* | *16.25* | *7.52* | *4.56* |
| Government | 4.34 | — | 2.91 | 4.96 | 10.24 | 2.65 | 1.09 |
| Private | 19.61 | 32.34 | 29.37 | 17.68 | 24.82 | 16.41 | 11.36 |

* Percentage of total funds. † Percentage of government funds. ‡ Percentage of private funds.

utilizes the broad research relationships developed through it.

The subject matter is presented under two systems, the single category method and the multiple category method. Under the former, each grant is placed in only one category to provide, for the purposes of this paper, a division of research funds among subject fields. Under the multiple system, which is based upon the index developed by the exchange, each grant is placed in as many major categories as the content of the project warrants but, it must be emphasized, is included only once within any individual major category. Listed below are the topics used in each of these systems.

*Single Subject Categories*

Ageing
Basic Studies
Blood
Cancer
Cardiovascular System
Dental Problems
Digestive System
Endocrine System
General Medical Problems
Human Resources
Infectious Diseases
Integumentary System
Mental Health
Metabolism and Nutrition
Musculoskeletal System
Nervous System
Occupational Diseases
Problems of Children
Public Health (including Environmental Sanitation)
Respiratory System
Sensory Organs
Urogenital System
Other

*Multiple Subject Categories*

Ageing
Allergy and Anaphylaxis
Anesthesia and Analgesia
Blood
Cancer
Cardiovascular System
Deficiency Diseases and Nutrition
Dental Research
Digestive System
Ecology and Environment
Emotional and Psychiatric States
Endocrine System
Infectious Diseases
Injury and Shock
Intoxication and Drug Addiction
Metabolism and Metabolic Diseases
Musculoskeletal System
Nervous System
Occupational Diseases
Problems of Children
Public Health
Respiratory System
Sanitary Engineering
Sensory Organs
Skin
Social Sciences
Stress
Urogenital System
Venereal Diseases

It is at once obvious that the topics under the two systems are in many instances not directly comparable. It was necessary, in the single category method, to employ more general topics to reduce in small measure, at least, the arbitrary factor of determining the field of major emphasis: thus the term Mental Health rather than the more limited Emotional and Psychiatric States of the multiple categories. Similarly, in the single category system, the term General Medical Problems has been employed to provide a place for those projects that are clinical in part and in which major emphasis went beyond a single condition or body system. In most instances the topics are self-explanatory and need no definition. Under

Figure 9

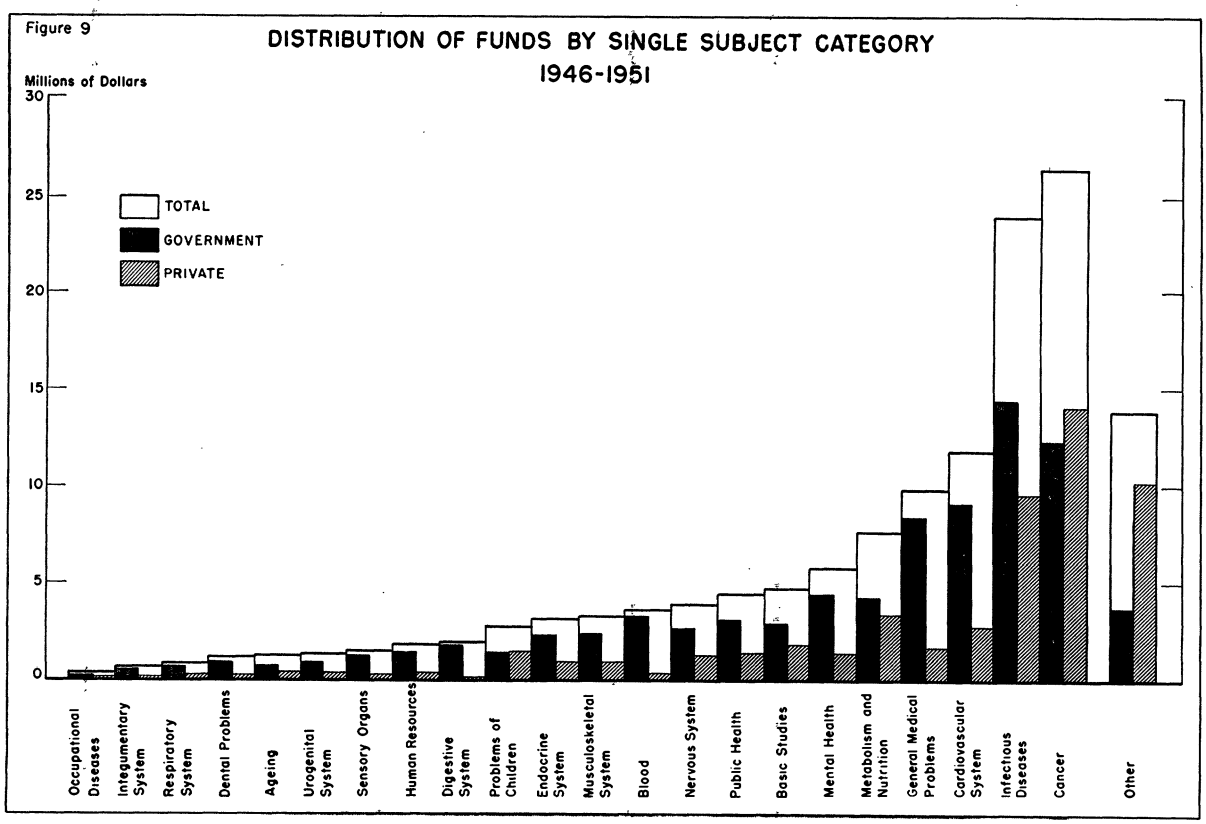


Figure 9a

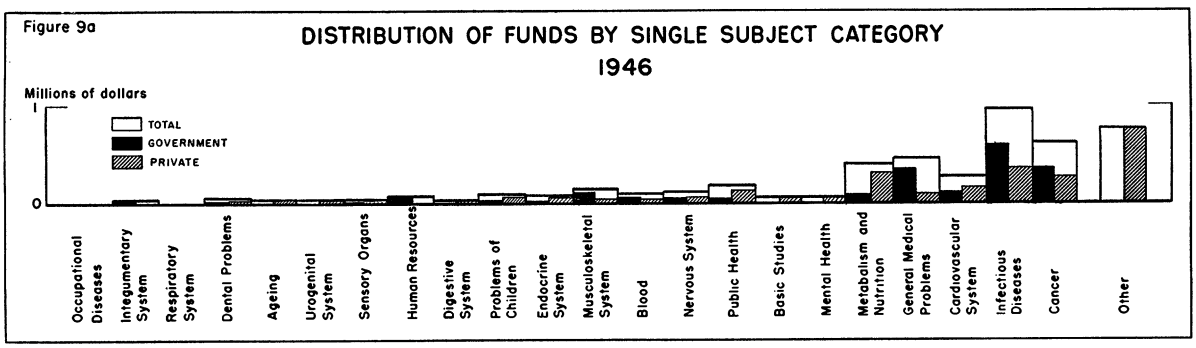



Figure 9b

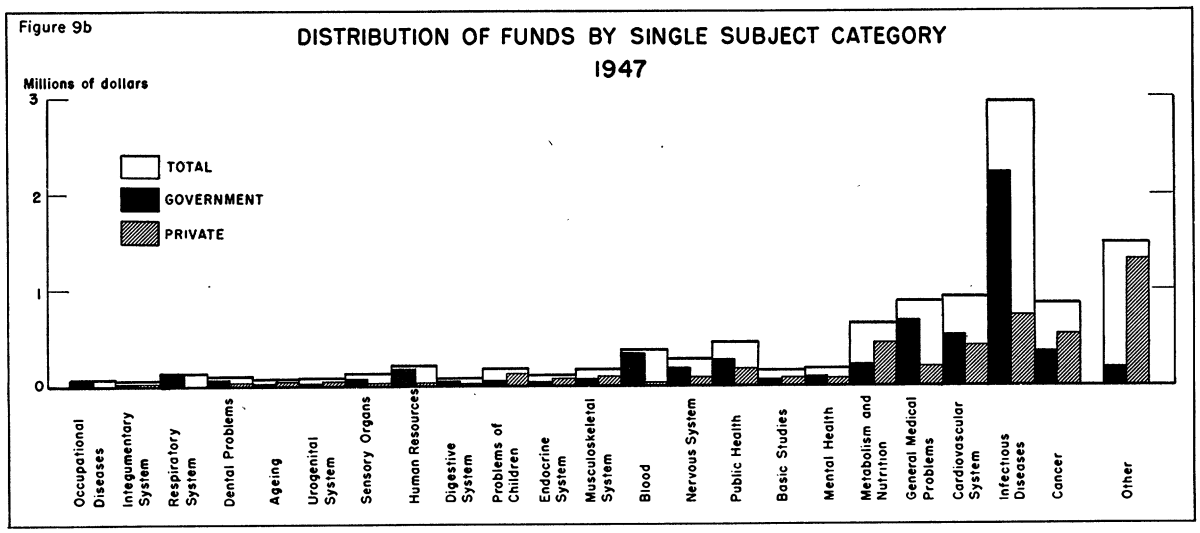



Figure 9c

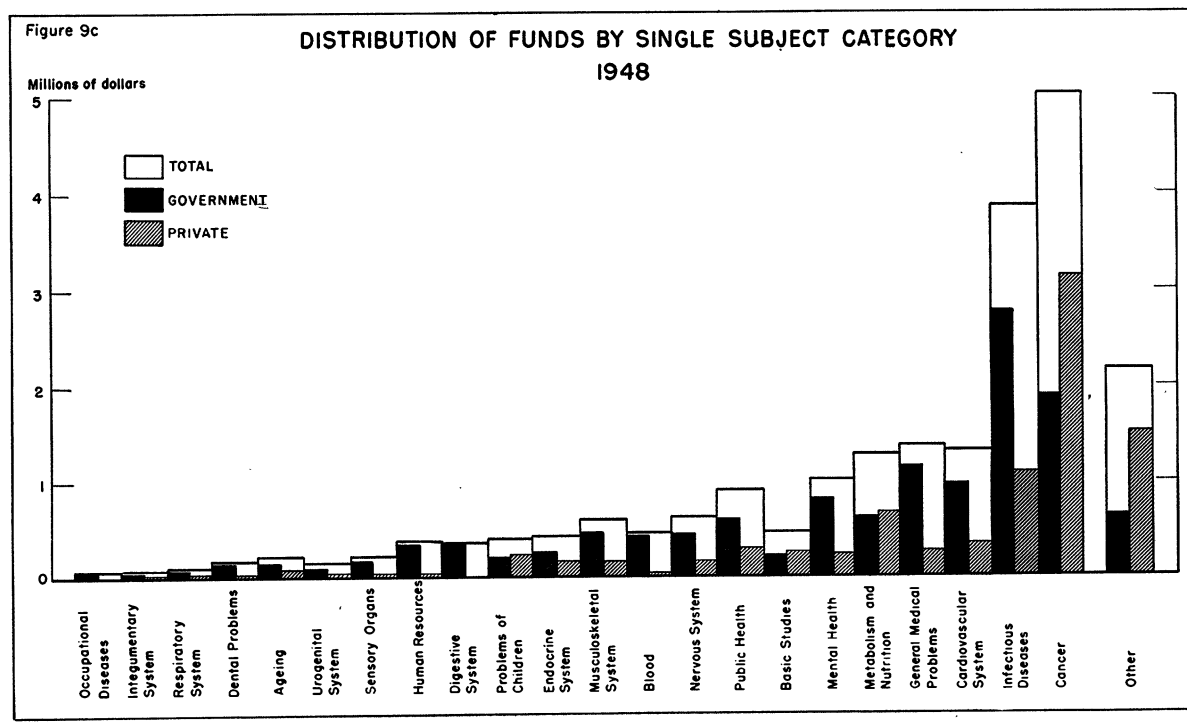


Figure 9d

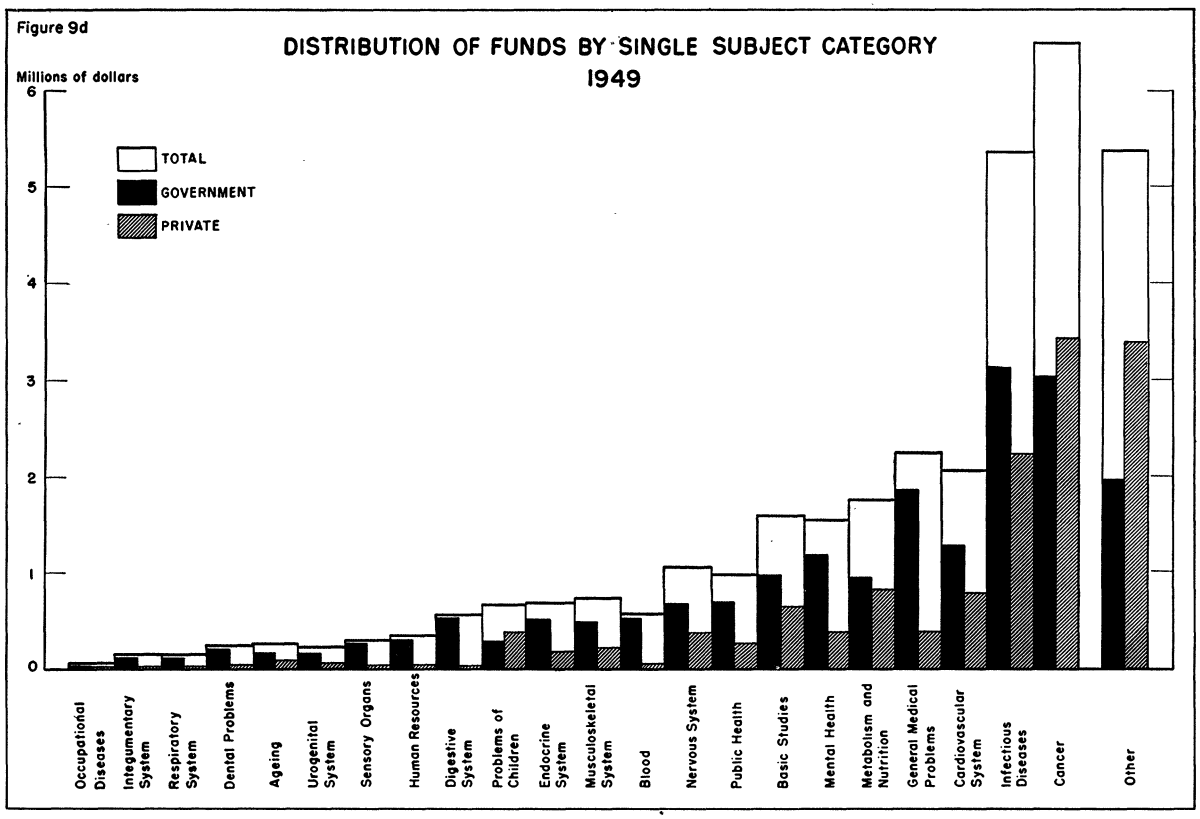
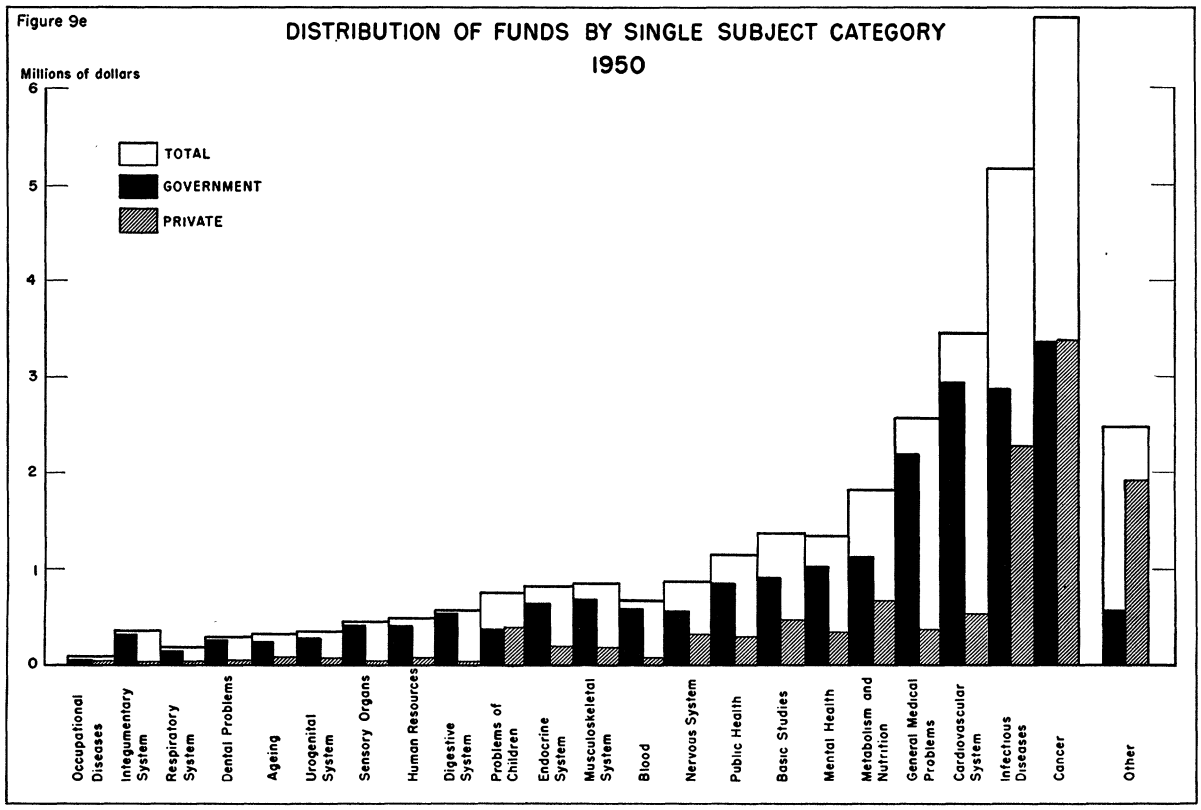
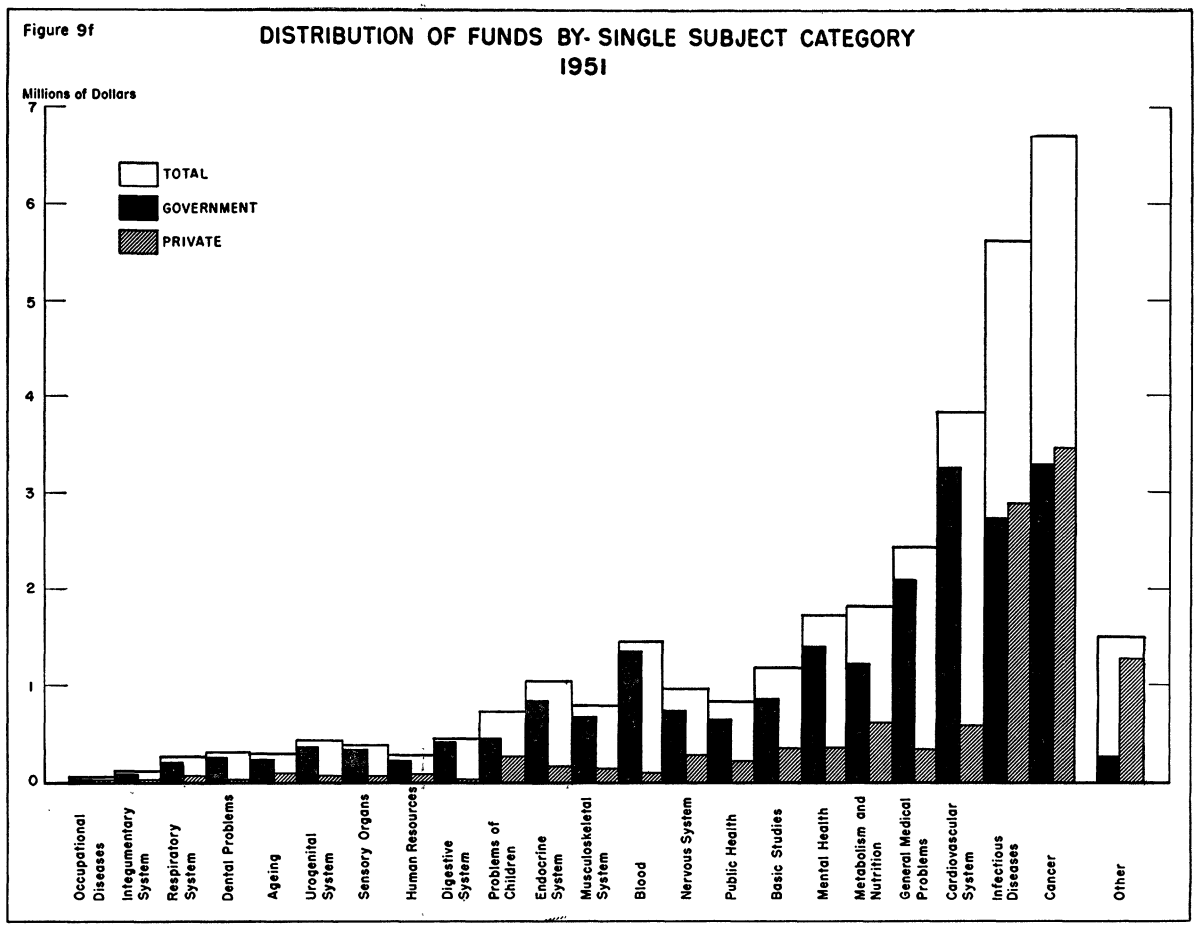



Figure 9e






both methods the Nervous System excludes nonneurological problems and the sensory organs; the latter appears as an individual topic. The category of Basic Studies contains only those purely basic problems which cannot be regarded as a part of more concise topics; basic studies of the digestive system, for instance, are included within that system.

This material is first examined through the single category system. By far the greatest amount of funds has been contributed to studies of Cancer and Infectious Diseases. With the exception of 1946, Cancer has derived greater support from private than from government sources. Infectious Diseases were supported more liberally by government agencies. Table 7 may be interpreted as illustrating five ranges of support in accordance with the percentage of total funds. The first range, 18% to 20%, includes Cancer and Infectious Diseases; the second, 7% to 9%, is comprised of the Cardiovascular System and General Medical Problems; the third, 3% to 6%, contains Metabolism and Nutrition, Mental Health, Basic Studies, and Public Health; the fourth, 1% to 3%, is composed of the Nervous System, Blood, the Musculoskeletal System, the Endocrine System, Problems of Children, the Digestive System, Human Resources, and the Sensory Organs. The final range, less than 1%, embraces the Urogenital System, Ageing, Dental Problems, the Respiratory System, the Integumentary System, and Occupational Diseases.

If, however, we view the distribution in terms of dollars rather than percentages, it becomes at once obvious that Occupational Diseases, the Respiratory System, and the Integumentary System are the only ones to which less than a million dollars has been made available over the period. The Urogenital System, Problems of Human Resources, the Sensory Organs, Ageing, Dental Problems, and the Digestive System have received between 1 and 2 million dollars over the total period, whereas 2½ to 4 million dollars has been made available for studies in the following fields: Musculoskeletal System, Nervous System, Blood, Problems of Children, and the Endocrine System. More than 4 million dollars has been allocated to Mental Health, Metabolism and Nutrition, Public Health, Basic Studies, General Medical Problems, Infectious Diseases, Cancer, and the Cardiovascular System. Figs. 9–9*f* illustrate the distribution of funds among these categories for the total period and for each fiscal year.

A glance at the annual distribution will show that funds for most topics increased as the total amount increased. In 1948 a sharp rise in the support of

cancer research is shown from both government and private sources. Increases in funds for the Cardiovascular System occurred in all years. Infectious Diseases have been liberally supported throughout the period. Metabolism and Nutrition shows a marked rise in 1948, but when it is remembered that in this year there was an increase of 100% in the total funds, it can scarcely be said that increased support for any field could result from more than additional available funds. The selection of topics for single subject categories was made on the basis of the research involved; fields which are not included have received little or no support.

The amounts awarded the single categories for the total period and for each successive year are presented in Table 8, which also shows the percentages of the amounts within each category contributed by government and private sources. Fig. 10 presents the percentile distribution of funds from government among the single categories, and Fig. 11 presents information concerning funds from private sources.

The subject analysis through the multiple category system, which now follows, is based upon a different approach to the data. At the expense of repetition it must be restated that under this system funds are included in more than one major topic, but only once within each. Funds allocated for cancer of the digestive system, by way of illustration, are included with those for the digestive system as well as those for cancer. Accordingly, funds within a category may be added, but those attributed to two or more categories

Figure 10

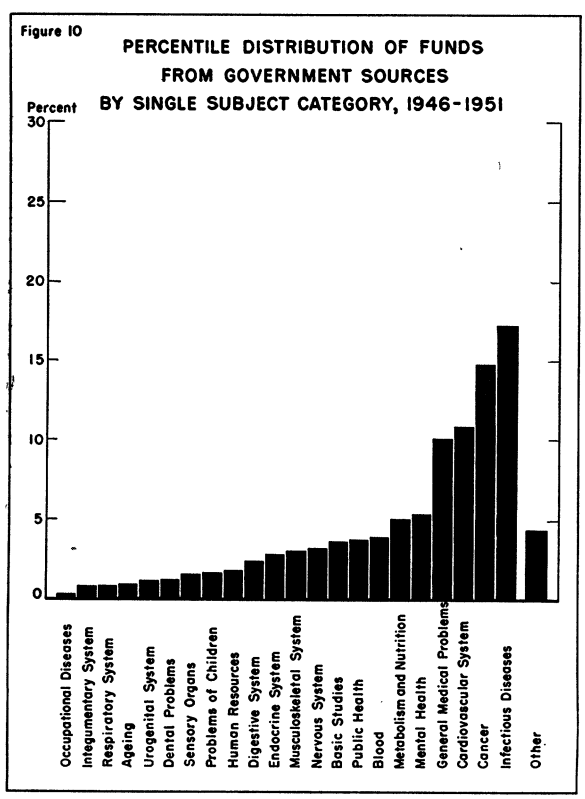
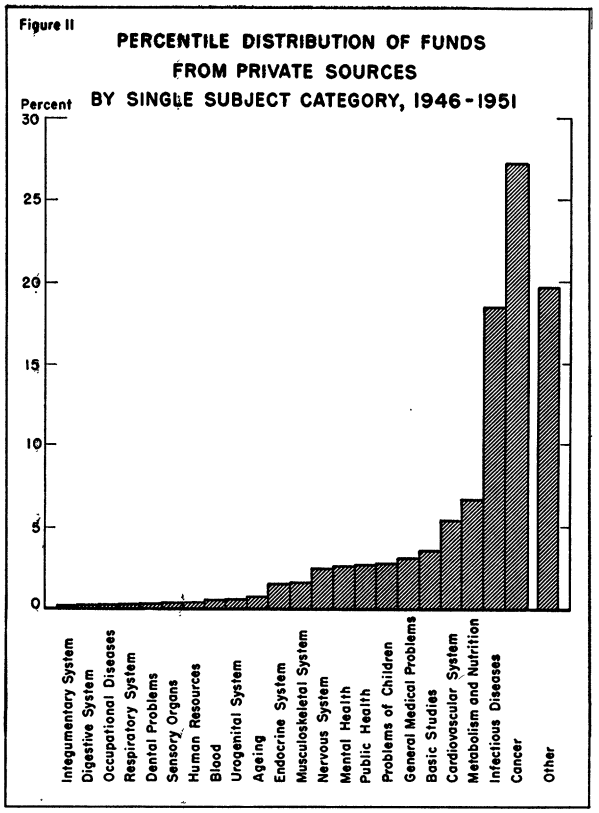



Figure 11




may not be combined. In the opinion of the authors, this system presents a more real picture of support of fields of research by including all problems with a reasonable relation to the subject, thereby eliminating many of the arbitrary decisions inherent in the single category system. This material also differs from the single category analysis in that it deals with selected topics and does not include the total body of the index. The topics chosen are believed to be those of greatest interest and most closely related to the topics evolved through the single category system. The material deals in the main with major categories and touches only slightly upon the divisions within them.

The multiple categories have also been grouped by levels of support, in this instance, to show progression of support through the six-year period. Table 9 presents not only the levels of support, but the order of magnitude of support of all topics which received, during any one year, $400,000 or more. It was not until 1948, when Cancer received a little more than 5 million dollars, that any area of research reached this level. In successive years, first, Infectious Diseases, second, Cardiovascular Research, and, last, Metabolic Studies were financed in amounts above 5 million dollars. Venereal Diseases is the only group relatively well supported in 1946 and 1947 which received under $400,000 in 1951.

There is no need to trace further the amount of support for each subject category through the suc-

TABLE 8

DISTRIBUTION OF FUNDS BY SINGLE SUBJECT CATEGORY

(Percentage of Funds within Each Category from Government and Private Sources)

| Subject category | 1946–51 | | 1946 | | 1947 | | 1948 | | 1949 | | 1950 | | 1951 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage |
| Ageing | *1,125,297* | | *24,493* | | *54,458* | | *211,581* | | *240,050* | | *311,640* | | *283,075* | |
| Government | | 67 | | 0 | | 17 | | 66 | | 68 | | 74 | | 75 |
| Private | | 33 | | 100 | | 83 | | 34 | | 32 | | 26 | | 25 |
| Basic Studies | *4,769,150* | | *38,900* | | *147,445* | | *452,612* | | *1,575,936* | | *1,374,590* | | *1,179,667* | |
| Government | | 62 | | 0 | | 47 | | 46 | | 60 | | 66 | | 72 |
| Private | | 38 | | 100 | | 53 | | 54 | | 40 | | 34 | | 28 |
| Blood | *3,534,811* | | *87,138* | | *359,216* | | *438,301* | | *555,789* | | *660,476* | | *1,433,891* | |
| Government | | 93 | | 86 | | 96 | | 96 | | 92 | | 90 | | 93 |
| Private | | 7 | | 14 | | 4 | | 4 | | 8 | | 10 | | 7 |
| Cancer | *26,389,761* | | *617,918* | | *844,654* | | *5,021,503* | | *6,492,101* | | *6,722,145* | | *6,691,440* | |
| Government | | 46 | | 58 | | 39 | | 38 | | 47 | | 50 | | 49 |
| Private | | 54 | | 42 | | 61 | | 62 | | 53 | | 50 | | 51 |
| Cardiovascular System | *11,832,433* | | *270,237* | | *921,003* | | *1,318,164* | | *2,052,470* | | *3,463,494* | | *3,807,065* | |
| Government | | 77 | | 38 | | 56 | | 75 | | 62 | | 85 | | 85 |
| Private | | 23 | | 62 | | 44 | | 25 | | 38 | | 15 | | 15 |
| Problems of Children | *2,752,629* | | *79,882* | | *161,236* | | *399,763* | | *665,633* | | *739,057* | | *707,058* | |
| Government | | 49 | | 10 | | 20 | | 48 | | 44 | | 49 | | 63 |
| Private | | 51 | | 90 | | 80 | | 52 | | 56 | | 51 | | 37 |
| Dental Problems | *1,090,653* | | *48,900* | | *76,862* | | *151,786* | | *225,367* | | *293,512* | | *294,226* | |
| Government | | 89 | | 39 | | 73 | | 93 | | 90 | | 90 | | 97 |
| Private | | 11 | | 61 | | 27 | | 7 | | 10 | | 10 | | 3 |
| Digestive System | *1,933,596* | | *2,500* | | *54,926* | | *338,405* | | *533,598* | | *561,281* | | *442,886* | |
| Government | | 99 | | 0 | | 98 | | 100 | | 99 | | 98 | | 98 |
| Private | | 1 | | 100 | | 2 | | 0 | | 1 | | 2 | | 2 |
| Endocrine System | *3,056,095* | | *45,400* | | *90,131* | | *412,840* | | *688,203* | | *813,927* | | *1,005,594* | |
| Government | | 75 | | 23 | | 40 | | 65 | | 74 | | 76 | | 85 |
| Private | | 25 | | 77 | | 60 | | 35 | | 26 | | 24 | | 15 |
| General Medical Problems | *9,919,701* | | *453,320* | | *888,031* | | *1,379,032* | | *2,221,424* | | *2,560,243* | | *2,417,651* | |
| Government | | 84 | | 79 | | 78 | | 83 | | 84 | | 86 | | 87 |
| Private | | 16 | | 21 | | 22 | | 17 | | 16 | | 14 | | 13 |
| Human Resources | *1,668,638* | | *48,576* | | *197,898* | | *348,834* | | *322,913* | | *488,088* | | *262,329* | |
| Government | | 89 | | 100 | | 93 | | 96 | | 93 | | 85 | | 77 |
| Private | | 11 | | 0 | | 7 | | 4 | | 7 | | 15 | | 23 |
| Infectious Diseases | *23,881,831* | | *955,367* | | *2,930,872* | | *3,868,708* | | *5,350,989* | | *5,163,800* | | *5,612,095* | |
| Government | | 60 | | 63 | | 75 | | 72 | | 59 | | 56 | | 49 |
| Private | | 40 | | 37 | | 25 | | 28 | | 41 | | 44 | | 51 |
| Integumentary System | *663,948* | | *10,798* | | *20,198* | | *48,137* | | *140,053* | | *344,479* | | *100,283* | |
| Government | | 97 | | 100 | | 88 | | 90 | | 97 | | 98 | | 97 |
| Private | | 3 | | 0 | | 12 | | 10 | | 3 | | 2 | | 3 |
| Mental Health | *5,788,200* | | *27,978* | | *164,426* | | *1,008,899* | | *1,539,352* | | *1,336,668* | | *1,710,877* | |
| Government | | 77 | | 0 | | 53 | | 79 | | 77 | | 75 | | 81 |
| Private | | 23 | | 100 | | 47 | | 21 | | 23 | | 25 | | 19 |
| Metabolism and Nutrition | *7,681,603* | | *396,582* | | *639,796* | | *1,289,448* | | *1,735,709* | | *1,814,817* | | *1,805,251* | |
| Government | | 55 | | 23 | | 32 | | 49 | | 54 | | 63 | | 67 |
| Private | | 45 | | 77 | | 68 | | 51 | | 46 | | 37 | | 33 |
| Musculoskeletal System | *3,226,545* | | *133,227* | | *167,574* | | *599,483* | | *701,593* | | *840,788* | | *783,880* | |
| Government | | 76 | | 80 | | 44 | | 77 | | 68 | | 79 | | 84 |
| Private | | 24 | | 20 | | 56 | | 23 | | 32 | | 21 | | 16 |
| Nervous System | *3,855,684* | | *98,295* | | *267,593* | | *618,307* | | *1,048,966* | | *864,632* | | *957,891* | |
| Government | | 68 | | 46 | | 69 | | 73 | | 64 | | 64 | | 74 |
| Private | | 32 | | 54 | | 31 | | 27 | | 36 | | 36 | | 26 |
| Occupational Diseases | *255,537* | | — | | *48,800* | | *57,546* | | *42,890* | | *68,954* | | *37,347* | |
| Government | | 84 | | — | | 100 | | 100 | | 91 | | 69 | | 60 |
| Private | | 16 | | — | | 0 | | 0 | | 9 | | 31 | | 40 |
| Public Health | *4,440,196* | | *147,356* | | *444,053* | | *908,134* | | *972,924* | | *1,143,890* | | *823,839* | |
| Government | | 69 | | 16 | | 60 | | 67 | | 72 | | 74 | | 76 |
| Private | | 31 | | 84 | | 40 | | 33 | | 28 | | 26 | | 24 |
| Respiratory System | *756,966* | | — | | *119,060* | | *80,360* | | *141,199* | | *174,491* | | *241,856* | |
| Government | | 87 | | — | | 100 | | 91 | | 87 | | 83 | | 82 |
| Private | | 13 | | — | | 0 | | 9 | | 13 | | 17 | | 18 |

TABLE 8—(*Continued*)

DISTRIBUTION OF FUNDS BY SINGLE SUBJECT CATEGORY
(Percentage of Funds within Each Category from Government and Private Sources)

| Subject category | 1946–51 | | 1946 | | 1947 | | 1948 | | 1949 | | 1950 | | 1951 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage | Amounts | Percentage |
| Sensory Organs | *1,438,788* | | *30,150* | | *108,253* | | *211,857* | | *291,819* | | *436,278* | | *360,431* | |
| Government | | 87 | | 50 | | 72 | | 82 | | 90 | | 94 | | 87 |
| Private | | 13 | | 50 | | 28 | | 18 | | 10 | | 6 | | 13 |
| Urogenital System | *1,191,170* | | *2,520* | | *72,200* | | *135,923* | | *205,998* | | *340,215* | | *434,314* | |
| Government | | 78 | | 0 | | 24 | | 68 | | 79 | | 85 | | 85 |
| Private | | 22 | | 100 | | 76 | | 32 | | 21 | | 15 | | 15 |
| All Other | *13,790,893* | | *787,904* | | *1,475,655* | | *2,158,124* | | *5,385,142* | | *2,483,405* | | *1,500,663* | |
| Government | | 26 | | 0 | | 11 | | 30 | | 37 | | 23 | | 16 |
| Private | | 74 | | 100 | | 89 | | 70 | | 63 | | 77 | | 84 |
| GRAND TOTALS | 135,044,125 | | 4,307,441 | | 10,254,340 | | 21,457,747 | | 33,130,118 | | 33,000,870 | | 32,893,609 | |
| Government | | 62 | | 43 | | 57 | | 60 | | 59 | | 65 | | 66 |
| Private | | 38 | | 57 | | 43 | | 40 | | 41 | | 35 | | 34 |

cessive years, but whereas only two areas of research were supported in the amount of a million or more in 1946 or 1947, there were twelve areas supported in this amount in 1948, fifteen in 1949 and 1950, and sixteen in 1951.

Although the greatest funds have consistently been assigned to studies concerned with Cancer, Infectious Diseases, and the Cardiovascular System, with each passing year other types of research gain increased support, and there is a constantly widening spread of funds among the various areas of medical investigation. Our experience demonstrates conclusively that it is the rare project whose significance is confined to a single field of research; consequently studies in

Figure 12

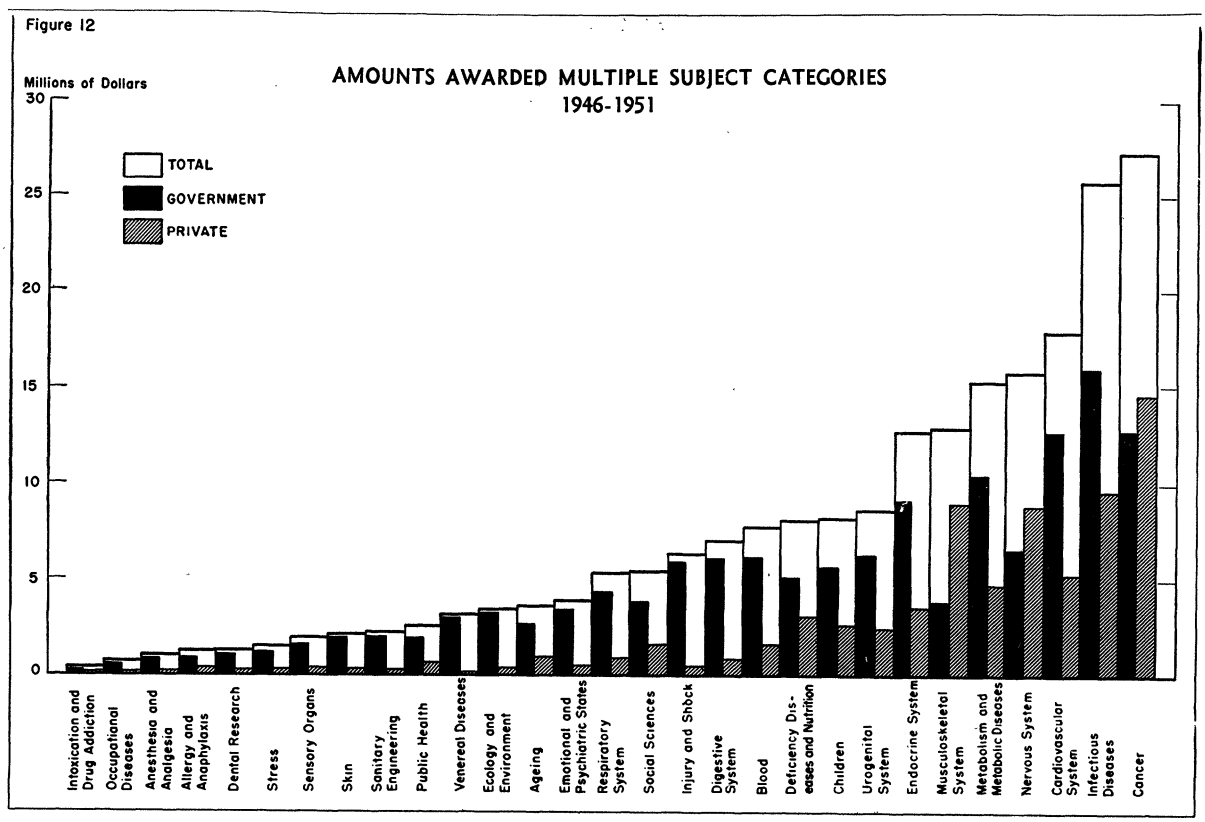


TABLE 9

ORDER OF MAGNITUDE OF SUPPORT OF SELECTED MAJOR MULTIPLE CATEGORIES

| Dollars (in millions) | Fiscal years | | | | | |
|---|---|---|---|---|---|---|
| | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 |
| 5 and above | | | Cancer | Cancer<br>Infectious Diseases | Cancer<br>Infectious Diseases<br>Cardiovascular System | Cancer<br>Infectious Diseases<br>Cardiovascular System<br>Metabolism and Metabolic Diseases |
| 3–4.9 | | Infectious Diseases | Infectious Diseases | Nervous System<br>Cardiovascular System | Metabolism and Metabolic Diseases<br>Nervous System<br>Endocrine System | Nervous System<br>Endocrine System<br>Musculoskeletal System<br>Blood |
| 1–2.9 | Infectious Diseases | Cardiovascular System | Nervous System<br>Metabolism and Metabolic Diseases<br>Cardiovascular System<br>Endocrine System<br>Musculoskeletal System<br>Problems of Children<br>Deficiency Diseases and Nutrition<br>Urogenital System<br>Digestive System<br>Injury and Shock | Metabolism and Metabolic Diseases<br>Musculoskeletal System<br>Endocrine System<br>Urogenital System<br>Deficiency Diseases and Nutrition<br>Problems of Children<br>Digestive System<br>Blood<br>Injury and Shock<br>Respiratory System<br>Social Sciences | Musculoskeletal System<br>Urogenital System<br>Deficiency Diseases and Nutrition<br>Problems of Children<br>Digestive System<br>Blood<br>Injury and Shock<br>Social Sciences<br>Respiratory System | Urogenital System<br>Deficiency Diseases and Nutrition<br>Problems of Children<br>Digestive System<br>Injury and Shock<br>Respiratory System<br>Social Sciences<br>Emotional and Psychiatric States |
| 0.4–0.9 | Cancer<br>Musculoskeletal System<br>Nervous System<br>Venereal Diseases<br>Deficiency Diseases and Nutrition | Cancer<br>Nervous System<br>Metabolism and Metabolic Diseases<br>Problems of Children<br>Musculoskeletal System<br>Urogenital System<br>Deficiency Diseases and Nutrition<br>Venereal Diseases<br>Respiratory System<br>Blood<br>Injury and Shock<br>Endocrine System<br>Digestive System<br>Ecology and Environment | Social Sciences<br>Blood<br>Respiratory System<br>Ecology and Environment<br>Venereal Diseases<br>Emotional and Psychiatric States<br>Ageing<br>Public Health<br>Sanitary Engineering | Emotional and Psychiatric States<br>Ageing<br>Ecology and Environment<br>Venereal Diseases<br>Sanitary Engineering | Ageing<br>Emotional and Psychiatric States<br>Integumentary System<br>Public Health<br>Ecology and Environment<br>Sanitary Engineering<br>Sensory Organs<br>Venereal Diseases | Ageing<br>Ecology and Environment<br>Stress<br>Integumentary System<br>Public Health<br>Sensory Organs<br>Sanitary Engineering<br>Allergy and Anaphylaxis |

Figure 12a

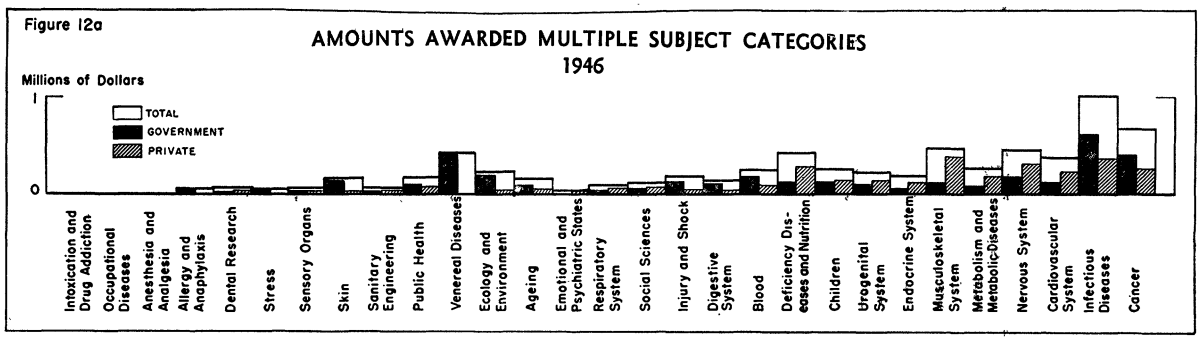



Figure 12b

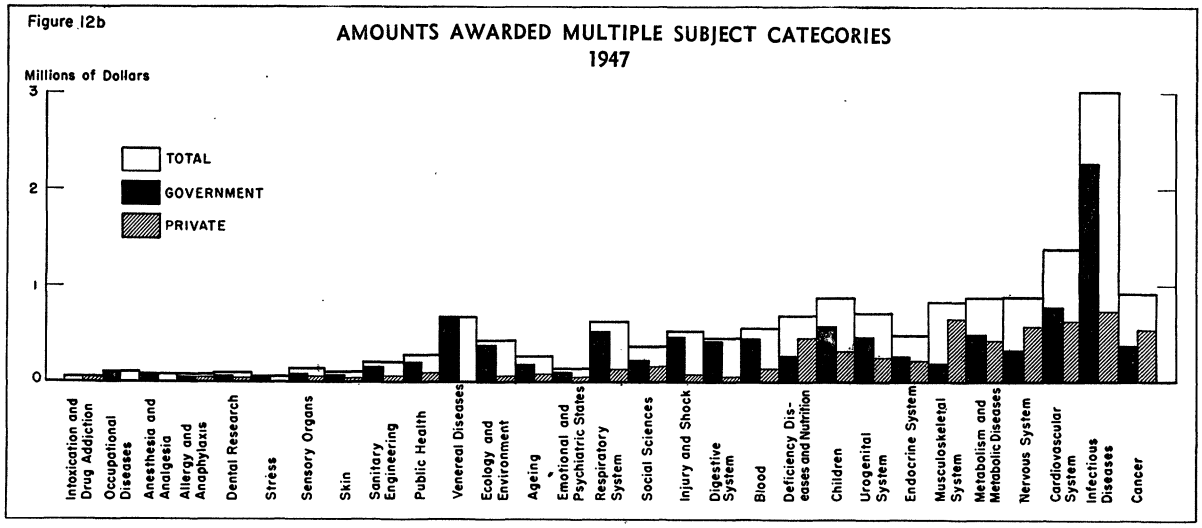



Figure 12c

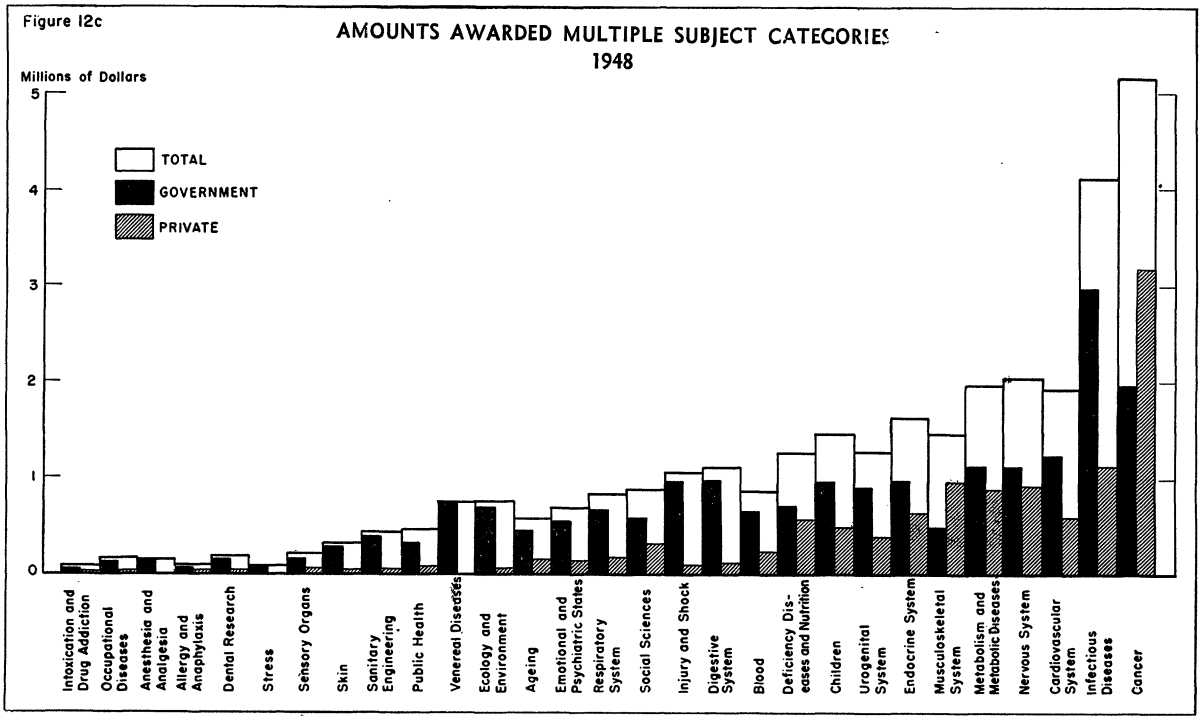


Figure 12d

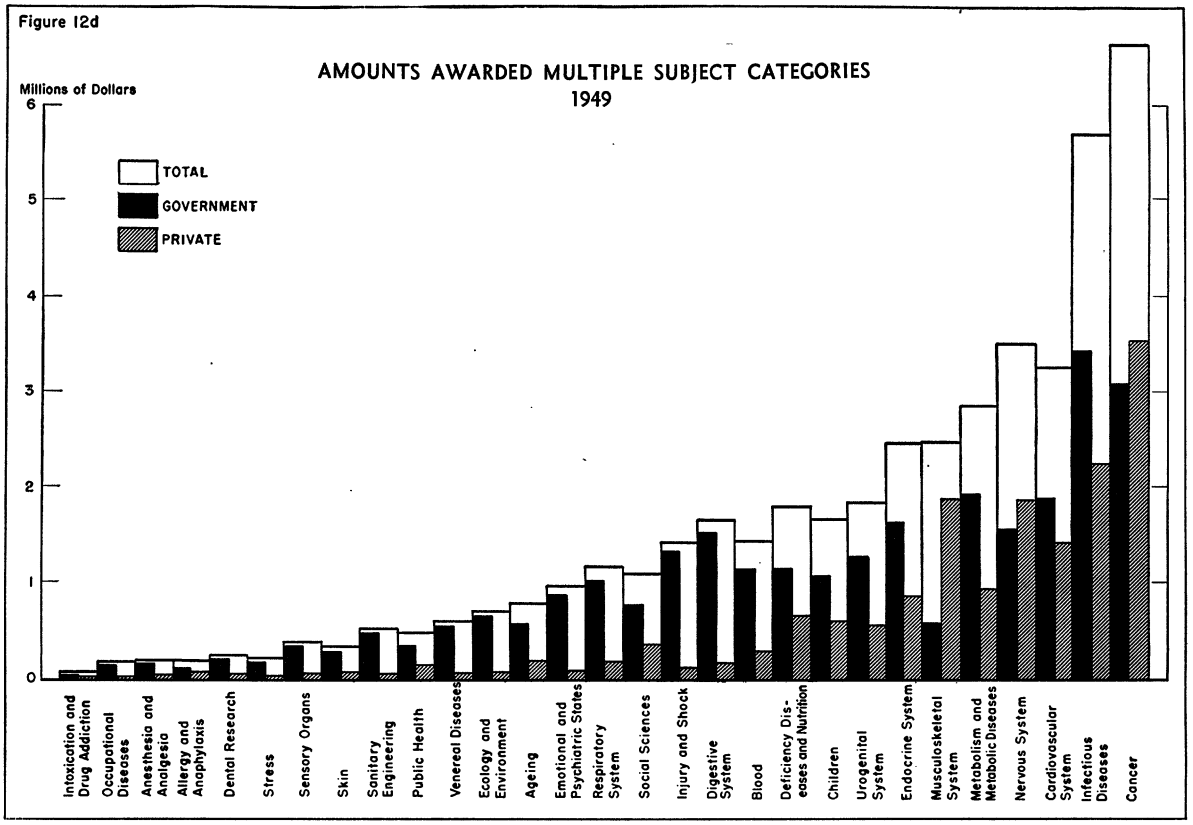



Figure 12e

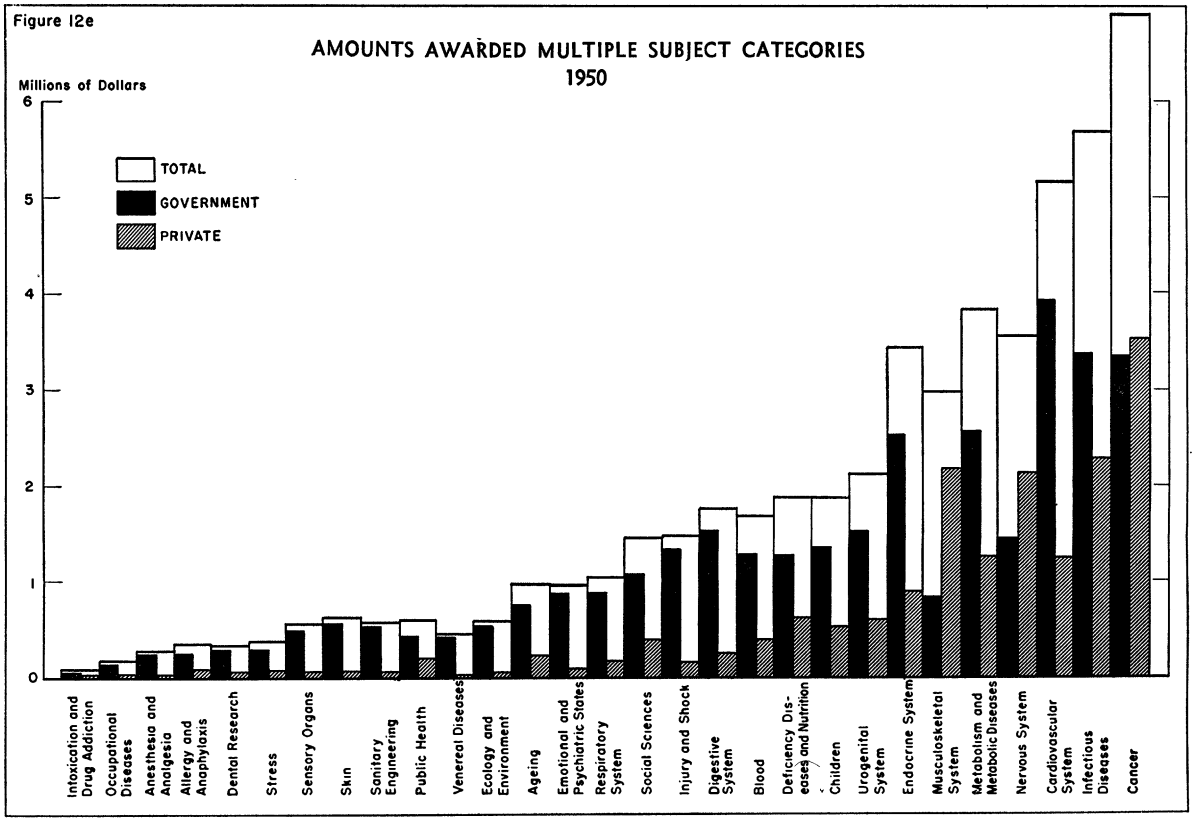
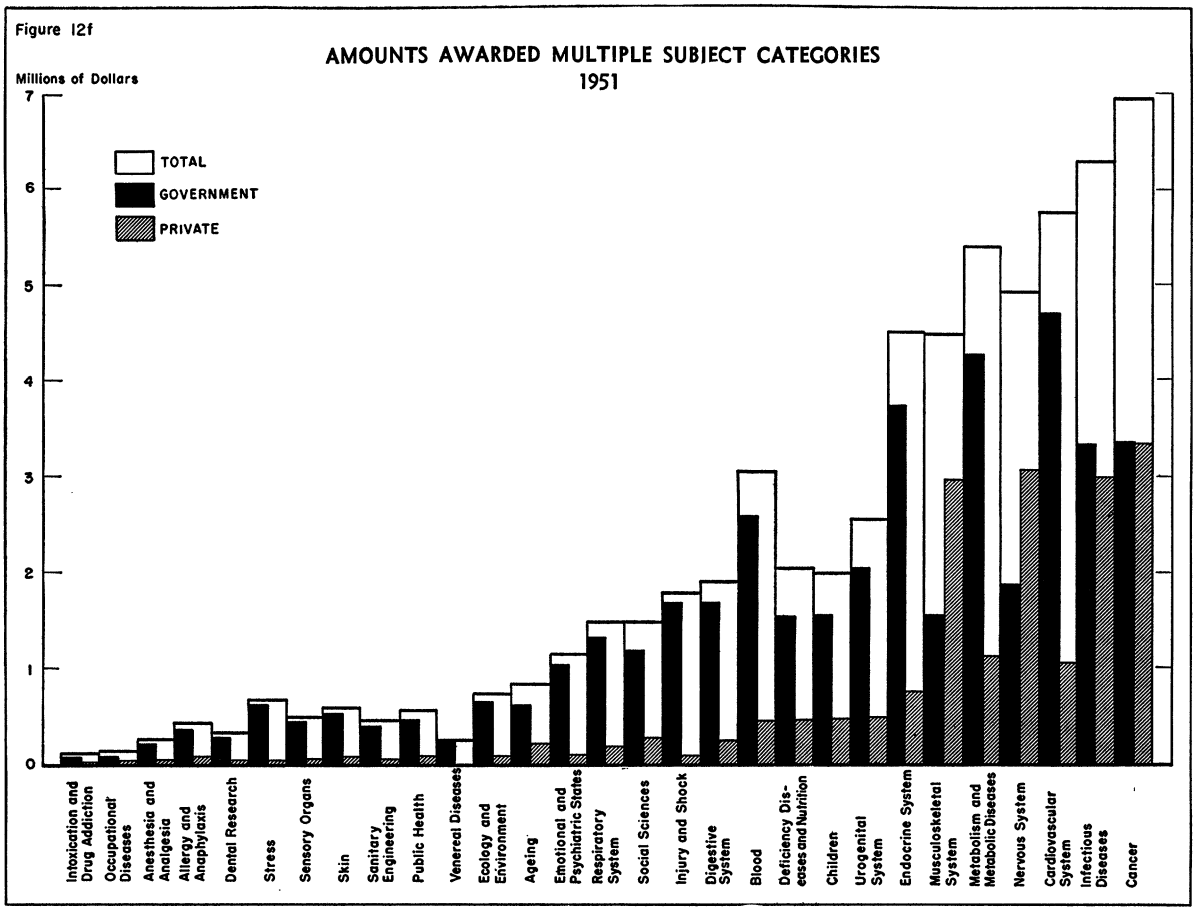


Figure 12f




the most heavily supported fields also contribute substantially to knowledge in other fields.

The amounts awarded the multiple subject categories during the total period and for each year concerned are presented in Figs. 12–12*f*. Particular diseases and conditions which received amounts of 1 million dollars or more throughout the period are shown in Table 10. Although cancer, as a disease, might logically belong to this group, it does not appear in the table. As a major category it comprises basic studies of such variety that direct comparison with subtopics of other categories is not possible.

The exchange maintains detailed information on the distribution of funds within the major multiple categories, but this detail is of such volume that it does not lend itself to reproduction in a paper of this nature. The emphasis within some of the major categories with which we have been dealing is briefly outlined as follows. Within the Blood System, cancer, chiefly leukemia, and the anemias have each received more than 1 million dollars of the 7 million total. In Cancer, approximately half the 27 million dollars has been granted to studies concerned with carcinogenesis and therapy. In the Cardiovascular System, emphasis has been placed in the following order: arteriosclerosis and hypertension, heart disease, and rheumatic conditions (which have merited a special topic). The Problems of Children embrace many studies of diseases which in the aggregate represent a fair percentage of the funds, but which individually are relatively meagerly supported as compared to the support of studies dealing with Mental Health of the Child or Pregnancy and the Newborn. Under the Digestive System, liver diseases, cancer, and enteric infections have received major support. Research on the Endocrine System falls into three groups: diseases of the endocrine system proper, which are not heavily supported, the role of the endocrines in cancer on which nearly 3 millions have been spent, and the role of the endocrines in other diseases to which 9 millions have been awarded.

Among the Infectious Diseases, poliomyelitis outranks all others, with tuberculosis second, syphilis third, and malaria fourth. The single source of funds for research in poliomyelitis represents an outstanding example of the role of a nongovernment agency in accepting the whole support of a particular disease. In the field of Metabolic Studies, metabolic diseases receive less emphasis than basic studies or the role of metabolism in other diseases. Diabetes, however, has received such substantial support during the past several years that it is among those diseases supported in amounts greater than 1 million dollars.

Within the Musculoskeletal System, basic research

TABLE 10

SPECIFIC AREAS OF RESEARCH SUPPORTED IN THE AMOUNT OF 1 MILLION OR MORE

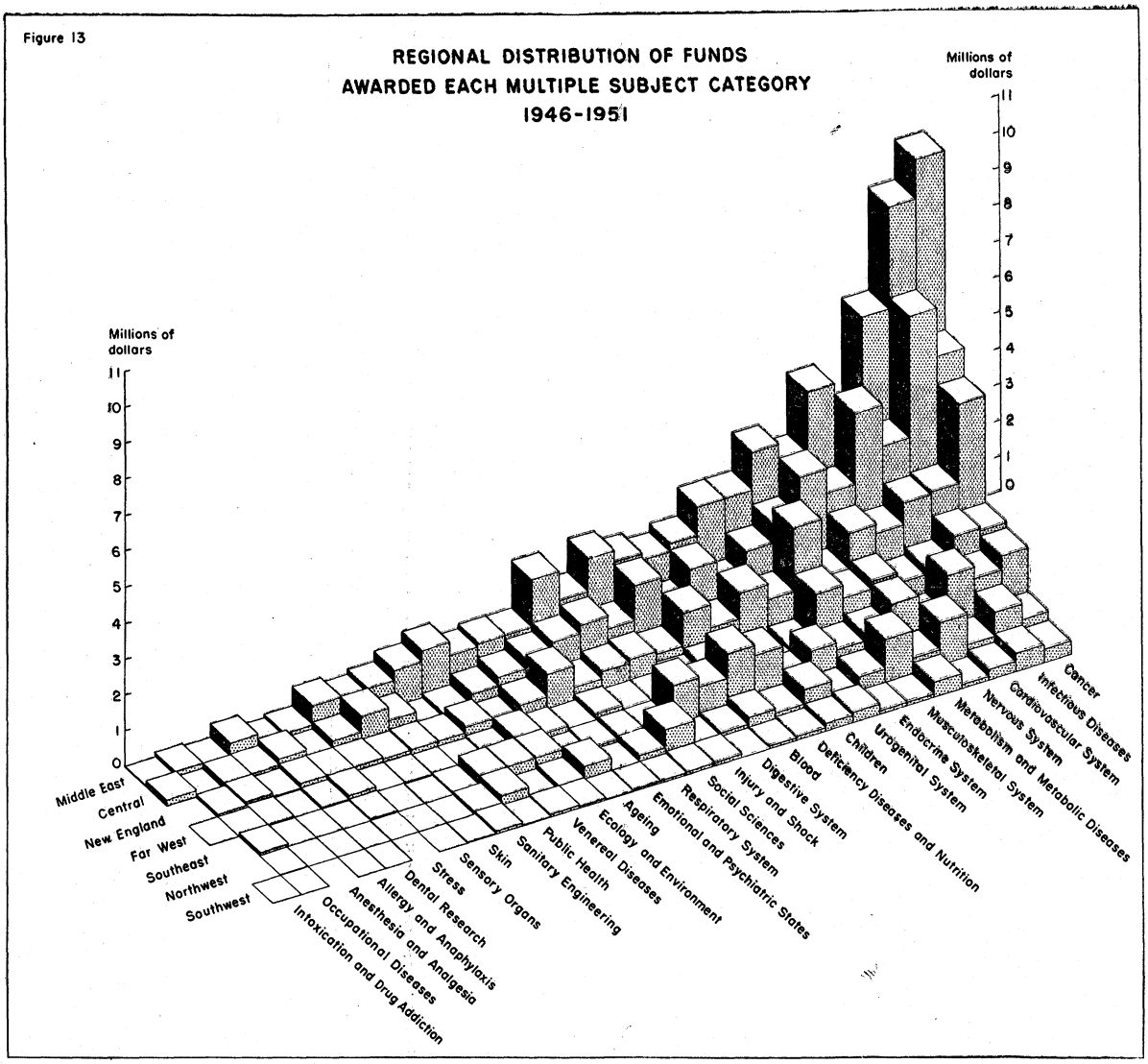
| | Total amount | Amounts by fiscal year | | | | | |
|---|---|---|---|---|---|---|---|
| | 1946–51 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 |
| Poliomyelitis | *7,331,825* | *242,186* | *491,918* | *746,267* | *1,513,123* | *1,729,027* | *2,609,304* |
| Government | — | — | — | — | — | — | — |
| Private | 7,331,825 | 242,186 | 491,918 | 746,267 | 1,513,123 | 1,729,027 | 2,609,304 |
| Arteriosclerosis and Hypertension | *4,859,905* | *83,118* | *445,180* | *604,773* | *900,438* | *1,229,359* | *1,597,037* |
| Government | 3,509,381 | — | 258,326 | 408,726 | 546,810 | 980,221 | 1,315,298 |
| Private | 1,350,524 | 83,118 | 186,854 | 196,047 | 353,628 | 249,138 | 281,739 |
| Kidney Diseases | *4,321,241* | *53,090* | *338,850* | *524,427* | *825,870* | *1,059,929* | *1,519,075* |
| Government | 3,476,324 | — | 227,150 | 418,745 | 648,052 | 873,226 | 1,309,151 |
| Private | 844,917 | 53,090 | 111,700 | 105,682 | 177,818 | 186,703 | 209,924 |
| Heart Disease | *3,282,030* | *58,026* | *218,029* | *315,923* | *494,998* | *1,018,278* | *1,176,776* |
| Government | 2,618,391 | 21,231 | 130,915 | 235,624 | 272,016 | 893,335 | 1,065,270 |
| Private | 663,639 | 36,795 | 87,114 | 80,299 | 222,982 | 124,943 | 111,506 |
| Rheumatic Conditions | *2,787,115* | *45,165* | *199,653* | *310,187* | *612,695* | *804,006* | *815,409* |
| Government | 1,357,642 | — | 84,126 | 165,389 | 156,530 | 359,517 | 592,080 |
| Private | 1,429,473 | 45,165 | 115,527 | 144,798 | 456,165 | 444,489 | 223,329 |
| Tuberculosis | *2,666,595* | *30,331* | *229,228* | *656,749* | *817,049* | *545,539* | *387,699* |
| Government | 2,229,956 | — | 204,647 | 528,384 | 647,384 | 493,704 | 355,837 |
| Private | 436,639 | 30,331 | 24,581 | 128,365 | 169,665 | 51,835 | 31,862 |
| Syphilis | *2,373,412* | *276,657* | *621,405* | *536,841* | *441,045* | *345,820* | *151,644* |
| Government | 2,366,912 | 276,057 | 620,805 | 536,241 | 440,445 | 345,220 | 148,144 |
| Private | 6,500 | 600 | 600 | 600 | 600 | 600 | 3,500 |
| Pregnancy and Newborn | *1,795,655* | *61,765* | *205,468* | *309,816* | *430,135* | *391,943* | *396,528* |
| Government | 1,223,857 | 34,565 | 139,634 | 181,740 | 262,259 | 283,134 | 322,525 |
| Private | 571,798 | 27,200 | 65,834 | 128,076 | 167,876 | 108,809 | 74,003 |
| Liver Disease (Excluding cancer) | *1,784,745* | *31,467* | *65,337* | *326,368* | *422,520* | *423,246* | *515,807* |
| Government | 1,714,459 | 25,267 | 61,337 | 315,818 | 400,784 | 408,646 | 502,607 |
| Private | 70,286 | 6,200 | 4,000 | 10,550 | 21,736 | 14,600 | 13,200 |
| Diabetes | *1,350,667* | *6,700* | *50,380* | *187,319* | *297,463* | *380,756* | *428,049* |
| Government | 1,073,639 | — | 25,580 | 141,908 | 242,622 | 309,985 | 353,544 |
| Private | 277,028 | 6,700 | 24,800 | 45,411 | 54,841 | 70,771 | 74,505 |
| Malaria | *1,320,990* | *50,800* | *269,416* | *325,422* | *298,366* | *245,097* | *131,889* |
| Government | 1,315,490 | 50,800 | 269,416 | 322,422 | 298,366 | 242,597 | 131,889 |
| Private | 5,500 | — | — | 3,000 | — | 2,500 | — |
| Enteric Infections | *1,260,897* | *48,471* | *196,943* | *208,727* | *284,366* | *290,072* | *232,318* |
| Government | 1,223,117 | 48,471 | 196,943 | 203,047 | 273,466 | 271,372 | 229,818 |
| Private | 37,780 | — | — | 5,680 | 10,900 | 18,700 | 2,500 |
| Studies on the Eye | *1,179,035* | *19,150* | *69,059* | *122,048* | *193,742* | *380,737* | *394,299* |
| Government | 980,301 | 4,150 | 39,059 | 80,648 | 156,462 | 350,093 | 349,889 |
| Private | 198,734 | 15,000 | 30,000 | 41,400 | 37,280 | 30,644 | 44,410 |
| Upper Respiratory Infections | *1,151,526* | *29,075* | *197,796* | *206,092* | *278,678* | *176,100* | *263,785* |
| Government | 1,063,126 | 15,800 | 181,786 | 187,527 | 251,608 | 171,850 | 254,555 |
| Private | 88,400 | 13,275 | 16,010 | 18,565 | 27,070 | 4,250 | 9,230 |
| Arthritis and Degenerative Joint Diseases | *1,146,113* | *78,000* | *49,320* | *69,075* | *226,561* | *248,343* | *474,814* |
| Government | 614,153 | — | 10,320 | 14,500 | 82,362 | 105,589 | 401,382 |
| Private | 531,960 | 78,000 | 39,000 | 54,575 | 144,199 | 142,754 | 73,432 |
| Mental Health of Children | *1,099,744* | *5,000* | *900* | *260,817* | *229,482* | *268,669* | *334,876* |
| Government | 954,348 | — | — | 156,317 | 214,806 | 266,169 | 317,056 |
| Private | 145,396 | 5,000 | 900 | 104,500 | 14,676 | 2,500 | 17,820 |
| Anemias | *1,082,686* | *68,570* | *110,320* | *192,302* | *187,530* | *213,985* | *309,979* |
| Government | 818,663 | 56,070 | 54,860 | 148,552 | 133,755 | 169,227 | 256,199 |
| Private | 264,023 | 12,500 | 55,460 | 43,750 | 53,775 | 44,758 | 53,780 |

on bone and joint and studies on arthritis and degenerative joint diseases received the major support; muscular atrophy and dystrophy were in second place, with fractures and bone surgery third. Paralytic conditions are far in the lead among studies of the Nervous System, with basic studies and convulsive disorders following in that order.

Within the Respiratory System, great emphasis has been placed upon upper respiratory infections, which have received approximately 1 million dollars, whereas all other respiratory diseases, including pulmonary tuberculosis, have been supported in the amount of 2.7 million.

With the exception of the eye, the Sensory Organs are poorly supported. Studies on the eye have had nearly 66% of the total available for all sensory organs. Within the Urogenital System, kidney disease is of the first order of magnitude, with cancer in second place. Venereal disease has not been included within this system.

Figure 13




The final approach to the multiple category material was the determination of the direction of research interest in the various regions. Fig. 13 illustrates this apportionment of funds. Only those research areas receiving the lowest support are not represented in all regions. It would appear that interest in every research field is nation-wide and that regional dispersion within categories follows closely that of total funds.

The review of this body of data, probably the largest accumulation of its kind maintained on a current basis, represents the first major report of the Medical Sciences Information Exchange. The data are, we believe, sufficient to permit the following conclusions:

1. Increasing governmental support of medical research has not diminished funds from private sources.

2. Geographically, the support of medical research by government and private sources is widely distributed and is in conformance with research potential.

3. There is no evidence of unreasonable duplication of research support by government and private agencies. Each source contributes to a substantial number of institutions not supported by the other, although there is mutual support of established institutions.

4. Most grants are small; 68% are in amounts below $10,000.

5. Support is widely distributed among investigators; 75% of them have received, over the six-year period, amounts which fall below the $37,000 mean or, in other words, an average of less than $6,000 in any one year.

6. The evidence shows that the annual grant system has provided continuity of support. At least 50% of all projects are receiving a minimum of three years of support.

7. The support of medical research is distributed among a wide variety of subject fields.

8. Our experience indicates that the extensive interrelationships among the fields of research spread the influence of the support of generously supplied areas well beyond the major fields of interest.