cally not controlling, since the publishers and secondary services are already committed to programs involving a high portion of fixed costs, significant among which are computer costs. Thus, products and services can be added at relatively low marginal costs, yet could, if properly designed, yield high marginal return, both in revenue to the supplier and in transfer of information to the scientists.

But the field of scientific information is strongly influenced by its source-oriented tradition and hampered by the unquantified nature of the value of information, by the wide diversity of information needs, by the variety of channels through which information flows, and by the variety of contexts in which any given piece of information appears.

More and more, these complex factors must be taken into account in the design of new information products and services in order for them to be accepted by users. If they are not, the flow of knowledge will slow down and, in an increasing number of instances, stop altogether from the pressure of strong economic constraints which are likely to continue for some time.

Scientists feel that the flow of scientific information has real social value and for it to diminish would be socially undesirable. The current flow rate has been made possible in essence by subsidy, in our journals via page charges, and in our secondary services by public money to finance the process improvements necessary to maintain the service in the face of rising costs and increasing volume. From the viewpoint of the user, enough funds have been available from the fact of rapid growth, both industrially and educationally.

Subsidies to the publishers are now diminishing, and the growth of the user community is decreasing, so the social value of the current flow rate of information must be demonstrated economically in order to be sustained.

The key factor affecting dissemination is clearly economics—the cost of receiving it (easily measured) compared with the value of having received it (measured with great difficulty at best). This puts scientific information into the same situation as most other commodities, where product performance, package design, distribution methods, and pricing take precedence over social and intellectual considerations. This is a difficult pill for science to swallow, as evidenced by its rather sluggish response to a situation which has been developing for five years and which was clearly foreseeable five years before that.

The additional talents needed for response are not primarily scientific, in my opinion, but rather behavioral. In this regard, scientific information is no different from scientific research, a conclusion that may provide some comfort to the statesmen of science and may make possible an increasing rate of response from here on.

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Papers Presented at ACS Meetings

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National meetings of the American Chemical Society have provided a forum for presentation of information since before 1900. Numbers of papers presented at these and other-than-national meetings are tabulated by year and by subject. National meetings have grown 5% per year, but other meetings have averaged 14% growth over the past decade. Most of the recent growth has involved the disciplinal divisions of the ACS rather than the interdisciplinal or the mission divisions. Over the years, meeting registrants per paper has risen from 5 to above 10 and dropped back to 5. Further changes are imminent, and the soundness of Society policy will depend upon correct interpretations of them.

Research comes to light and contributes to the progress of science through the papers that are published in the journals. That statement is probably more right than wrong, but it is certainly not the whole story. Traditionally, research is "trial marketed" before publication: the author first presents his results at a meeting, in exchange for informed comments, and his plans for publication may be influenced considerably by them. Actually, he may have discussed his findings with others still earlier, or revealed his plans in requests for financial support even before the work was begun. But these were privileged contacts, whereas anyone interested can attend the meetings.

National meetings of the American Chemical Society are one such forum for exchanging research results and informed comments. Subjects are portioned among Divisions of the Society, and programs are supplied to all members through Chemical and Engineering News. Thousands of members regularly attend hundreds of papers at every national meeting, but most now feel that big national meetings no longer answer their needs, and should give way to "something better." Certainly such a critical problem deserves analysis in search for possible solutions, especially as the Society approaches its centennial year of 1976.

NATIONAL MEETINGS

Table I lists papers presented by Divisions at national ACS meetings year-by-year during four twenty-year periods that correspond approximately to four stages in the development of national meetings.

Although the first meeting of the Society was held in Newport, Rhode Island, in 1890, the future pattern was really set by the "World's Congress of Chemists," which was held in Chicago in connection with the Columbian Exposition of 1893. Not for a decade would its 76 papers be exceeded, and not for half a century would all its nine subject matter areas become Divisions. But when the time came, the pattern was there.

From the second 20 years the present structure emerged. There were eight Divisions in 1910 and 19 in 1930. By then, Organic Chemistry and Physical and Inorganic Chemistry both exceeded 100 papers a year and "general" papers had all but disappeared.

The third 20 years grew in size rather than in variety. Three Divisions passed 200 papers a year. Analytical was founded, and Dye and Leather were replaced by Literature and Polymer. There were several adjustments in names.

The last 20 years have still seen beginnings, growth, and adjustments, but not to the extent of earlier periods. Most divisions have grown in numbers but slowly in percentage. The impression is one of maturity.

A general picture of ACS national meetings is offered by Figure 1. Numbers of papers are expressed as three-year moving averages to temper discontinuities associated with unusually large or small programs in certain cities. This averaging period was selected to accommodate to the Chicago–Atlantic City–New York cycle of fall meetings that prevailed during the 1950's and 1960's.

Around 1900, the number of papers presented sprouted at a rate of 35% per year. By 1906 the demand had been satisfied, and a rate of increase of 5% per year is shown thereafter. Two large deviations from this rate are associated with the two world wars. World War I was characterized by a small decline followed by a large recovery, whereas World War II was characterized by a large decline followed by a small recovery.

Figure 1 shows little evidence for any influence of federal support of research. The best case that can be made is the defensive one that the decline of the early 1960's might have been worse without it. But common sense argues that an expenditure of tens of billions of dollars must have had more effect than that.

An obvious answer is that many chemical-research papers are presented at other meetings. Since World War II especially, the ACS national meetings have had increasing competition from other types of meetings within the Society, as well as from parallel national meetings of other societies. Especially in the fields that chemistry shares with other disciplines—chemical engineering, chemical physics, geochemistry, molecular biology—competition is inevitable.[1]

OTHER MEETINGS

Inside competition for national meetings is presented in Table II, which lists numbers of papers presented annually before divisional symposia, local section symposia, meetings-in-miniature, and regional meetings. Division symposia have a long tradition, National Colloid having started in 1926 and National Organic in 1927. Local section symposia have always been dominated by analytical chemistry, particularly the Pittsburgh Conference. Meetings-in-miniature are usually run by local sections but involve a variety of subjects. Regional meetings began with Southwestern in 1945 and nearly all local sections now participate cooperatively in one or more of the ten extant.

These alternative meetings have in effect been taking part in a long-term, large-scale experiment to determine how national meetings are best supplemented. The results are shown in Figure 2. Five patterns all started nearly even with about 100 papers around 1945:

The "meeting-in-print" satisfied no one and was never repeated, once wartime restrictions on conventions were lifted.

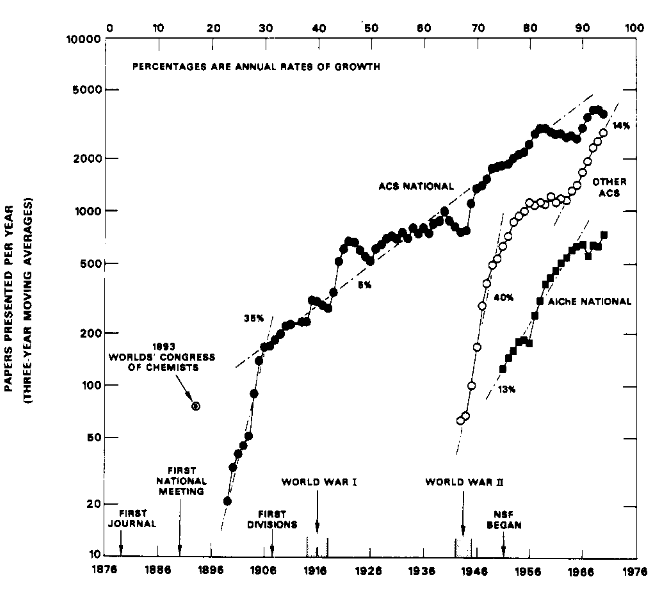

Figure 1. Papers presented at national meetings

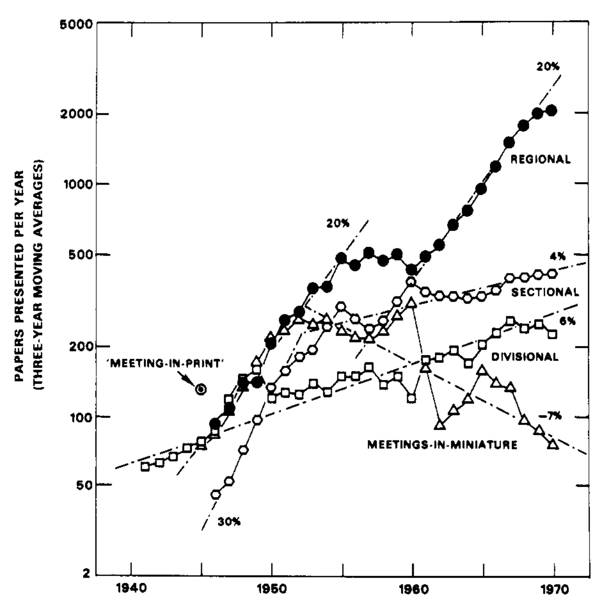

Figure 2. Papers presented at meetings other than national

Table I. Numbers[a] of Papers Presented before Divisions at National Meetings

1893–1910 Beginnings

	1890	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
Agricultural & Food				16										3	6	21	32	26	21	48	(30)
Fertilizer				15 (analytical)															10	12	17
Biological				2 (literature)												21	42	16	15	20	46
Pharmaceutical				1 (sanitation)															8	11	5
Education				6																11	8
Ind. Chem. & Chem. Engr.				18											3	5	19	24	(25)	26	31
Inorganic				4										9	8	6	27	39	20	[b]	[b]
Physical				6										3	10	31	33	30	34	56	48
Organic				8											3	26	13	37	34	(30)	(30)
General	[c]	[c]	[c]	0	[c]	[c]	[c]	[c]	[c]	21	34	43	42	35	32	6	4	9	(14)	(13)	(12)
Total	[c]	[c]	[c]	76	[c]	[c]	[c]	[c]	[c]	21	34	43	42	50	62	116	170	181	181	227	227

1911–1930 Growth

	1911	12	13	14	15	16	17	18	19	20	21	22[c]	23[c]	24[c]	25[c]	26	27	28	29	30
Agricultural & Food	21	0	(30)	(30)	12	32	27	7	30	23	32	[c]	[c]	[c]	[c]	31	18	63	44	43
Fertilizer	9	0	(15)	(15)	45	16	13	6	10	13	21	[c]	[c]	[c]	[c]	17	12	19	15	24
Biological	74	0	(50)	(60)	(70)	108	74	40	86	72	61	[c]	[c]	[c]	[c]	39	32	54	69	54
Medicinal	27	0	(20)	(20)	6	20	20	8	15	23	24	[c]	[c]	[c]	[c]	20	23	10	19	72
Education											10	[c]	[c]	[c]	[c]	50	43	36	40	48
History																17	21	13	9	17
Ind. Chem. & Chem. Engr.	28	0	(30)	(35)	36	52	41	30	74	86	57	[c]	[c]	[c]	[c]	42	70	22	28	43
Leather										19	24	[c]	[c]	[c]	[c]	16	13	21	11	9
Paint, Varnish, Plastics																11	37	33	25	30
Petroleum											27	[c]	[c]	[c]	[c]	50	37	59	29	20
Gas and Fuel														[c]	[c]	27	28	9	22	25
Rubber						7	8	5	22	24	32	[c]	[c]	[c]	[c]	24	26	37	8	32
Organic	29	0	(30)	(30)	30	87	36	15	46	52	82	[c]	[c]	[c]	[c]	59	66	83	84	102
Sugar										30	57	[c]	[c]	[c]	[c]	26	12	33	25	26
Cellulose											29	[c]	[c]	[c]	[c]	11	12	24	24	24
Dye									27	37	32	[c]	[c]	[c]	[c]	21	31	22	8	13
Physical & Inorganic	48	0	(50)	(50)	26	80	66	13	69	102	128	[c]	[c]	[c]	[c]	60	77	118	134	127
Colloid																0	7	12	16	9
Water, Sewage, Sanitation					13	45	11	4	8	11	14	[c]	[c]	[c]	[c]	15	32	30	21	28
General	(10)	0	(10)	(10)	(10)	(10)	7	0	26	0	11									
Total	246	0	235	250	248	457	303	128	413	492	641	690[c]	678[c]	670[c]	447[c]	536	587	698	631	756

1931–1950 Adjustment

	1931	31	33	34	35	36	37	38	39	40	41	42	43	44	45[d]	46	47	48	49	50
Agricultural & Food	58	61	55	65	59	49	47	30	49	75	78	66	55	58	11	72	82	82	140	115
Fertilizer	17	0	21	23	0	26	19	15	22	27	18	27	26	23	0	28	24	25	23	17
Analytical & Micro						24	25	24	43	21	58	35	24	50	19	48	68	90	65	100
Biological	63	54	103	54	100	69	75	84	110	88	105	76	85	138	2	159	168	194	205	246
Medicinal	79	40	44	50	36	46	40	29	45	40	42	22	21	48	10	85	71	48	47	67
Education	53	29	23	33	42	39	46	56	58	59	59	48	47	55	2	87	120	115	74	73

Meetings-in-miniature rose 20% per year to 250 papers in 1952, but since then have fallen below 100.

Divisional symposia rose 6% per year—about the same rate as national meetings—and barely reached 250 papers by 1968.

Local section symposia, after a few years at a lush 30% rate, climbed at 4% to 400 papers by 1968.

Regional meetings grew at a full 20% annual rate, except for a five-year span in the late 1950's.

Thus regional meetings outdistanced the other patterns by almost an order of magnitude. The 2142 papers presented at nine regional locations in 1970 exceeded the number presented at any single national meeting other than the 2387 at New York in the fall of 1969.

Although the regional meetings now compete sucessfully with any one national meeting, the two national meetings per year still draw more papers than all other meetings combined:

	1967	1968	1969	1970
Two national meetings	3688	4116	3726	3535
Other ACS meetings	2113	2752	2666	2885
Total papers presented	5801	6868	6392	6420
% Other	37	40	42	45

History	6	11	16	7	9	16	11	18	26	23	34	15	—	—	—	17	16	16	26	49
Indust. & Engineering	37	40	42	16	87	19	38	42	43	53	46	42	61	60	18	110	104	119	146	164
Leather; Literature	8	0	8	0	10														40	46
Paint, Coatings	44	32	32	27	30	27	40	25	51	49	40	34	19	28	11	47	29	54	78	45
Petroleum	46	21	53	11	45	32	28	36	55	41	53	27	37	54	20	54	47	51	136	90
Gas and Fuel	21	14	40	43	46	41	38	17	30	19	21	24	18	14	0	9	26	21	26	38
Rubber	29	8	33	20	9	19	25	—	50	35	32	32	23	0	1	73	50	29	20	26
Organic	90	51	136	70	114	81	109	80	143	121	123	93	95	145	8	162	169	176	218	288
Sugar; Carbohydrate	26	24	26	13	20	16	16	34	24	22	45	23	30	56	5	54	51	52	53	74
Cellulose	20	19	29	12	17	35	41	10	42	23	42	19	14	22	3	21	46	20	32	34
Dye; Polymer	10	0	18																	45
Physical & Inorganic	149	99	173	141	179	172	183	131	204	170	160	99	71	64	10	217	161	252	296	332
Colloid	20	15	31	19	33	26	16	11	21	26	25	22	29	25	2	58	57	83	63	94
Water, Sewage, Sanitation	21	34	29	31	20	29	26	25	21	28	23	30	32	20	0	40	51	48	39	61
Total	797	552	912	635	856	766	823	667	1037	920	1004	734	687	862	132[d]	1341	1340	1475	1730	2064

1951–1970 Maturity

	1951	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
Agricultural & Food	105	114	151	116	137	139	107	165	147	138	166	116	114	93	149	96	173	239	134	109
Fertilizer & Soil	22	22	25	24	20	23	27	24	34	36	35	36	36	31	22	34	22	29	54	22
Pesticide																			36	96
Analytical	101	111	118	97	93	198	224	224	195	206	177	139	163	142	158	110	356	268	146	253
Biological	126	226	294	293	302	253	402	311	342	338	292	377	327	140	260	311	277	287	341	252
Medicinal	58	64	91	75	60	81	98	108	109	135	102	121	149	92	101	100	103	125	114	92
Microbial											50	28	42	46	34	43	79	0	73	49
Education	49	52	65	59	57	104	96	76	85	79	88	59	60	48	36	75	63	78	100	96
History	22	25	25	39	24	39	44	86	47	24	29	52	37	24	39	8	23	80	19	41
Literature	65	79	75	80	111	128	108	79	53	76	79	101	60	84	58	75	39	78	70	49
Indust. & Engineering	141	155	149	185	218	165	282	214	214	164	165	116	135	86	87	111	125	119	83	132
Marketing & Economics			80	56	61	77	47	75	76	59	36	57	52	27	5	43	47	52	44	52
Petroleum	98	78	121	106	113	151	122	149	127	122	102	93	96	114	123	110	112	149	171	159
Fuel	46	32	24	48	42	41	41	18	67	45	52	57	59	75	106	60	177	60	98	73
Organic	199	272	251	269	218	249	302	361	378	357	295	256	396	280	284	296	390	422	358	397
Carbohydrate	68	67	90	100	69	85	83	94	90	85	72	67	90	110	130	53	106	110	113	94
Cellulose	40	36	35	34	67	79	52	59	84	72	65	67	65	48	57	28	107	76	89	76
Polymer	68	85	64	103	66	98	107	170	129	106	89	120	149	139	132	95	154	232	221	186
Coatings & Plastics	63	74	55	45	84	76	128	90	101	80	65	81	98	71	79	72	148	100	96	112
Rubber	40	0	43	35	0	27	26	33	0	29	25	0	40	38	0	36	24	32	0	0
Physcial	167	205	279	273	246	253	320	316	278	308	291	262	425	164	336	335	345	494	425	426
Colloid & Surface	96	50	62	43	45	56	121	104	116	119	124	113	132	91	80	127	197	211	170	145
Inorganic	b	b	b	b	b	b	89	225	253	215	215	198	167	194	162	293	286	396	406	247
Fluorine														60	36	39	19	55	44	21
Nuclear													12	52	127	106	187	311	180	160
Water, Air, & Waste	55	42	37	35	37	35	40	61	66	82	91	115	140	107	95	96	129	113	141	184
Total	1629	1789	2137	2115	2070	2357	2866	3042	2991	2875	2705	2631	3044	2356	2696	2772	3688	4116	3726	3535

[a] Numbers in parenthesis are estimates. [b] Included in Physical. [c] No data available. [d] Meeting-in-print.

But if the percentage of papers presented at other meetings continues to climb at this rate, national meetings will soon lose their preeminence. Figure 1 supports that prediction. As a group, other meetings have been growing at an annual rate of 14%, compared with the long-range 5% for national meetings, and perhaps 8% for national and other meetings combined.

An additional pattern is provided by the American Institute of Chemical Engineers, as an example of national meetings of a separate organization. Actually, two to four AIChE meetings are held annually to give the totals shown in Figure 1. From 1951 until the numbers of papers levelled off at about 650 in 1966, growth was 13%—nearly as fast as non-national ACS meetings. In scope, the AIChE somewhat resembles a group of allied ACS divisions, so that a rate nearer the 6% of divisional symposia might have been expected.

SIGNIFICANCE

The various growth rates can be given a variety of individual explanations, but three predominant factors probably explain the major characteristics of the rise. Initial growth rates of 30 to 40% represent unrestricted expansion of a comparatively unlimited supply of papers into new

Table II. Numbers[a] of Papers Presented at Other Meetings

1941–1950 Beginnings

	1941	42	43	44	45	46	47	48	49	50
Division Symposia										
National Colloid	[b]	[b]	[b]	[b]	[b]	29	28	31	30	28
National Organic	[b]	—	[b]	—	[b]	—	12	—	12	—
Christmas Chem Eng	[b]	[b]	[b]	[b]	[b]	(20)	20	21	24	19
Summer Analytical							0	8	15	13
Summer Medicinal						0	—	17	—	12
Rubber	[b]	[b]	[b]	[b]	[b]	(35)	34	45	25	46
Others										
Total	(60)	(60)	(70)	(70)	(80)	84	94	178	159	140
Local Sections										
Pittsburgh Analytical						[b]	[b]	35	[b]	[b]
Delaware Chemistry									[b]	[b]
Others								31	(40)	(50)
Total						(40)	(50)	66	100	125
Meetings-in-Miniature					12[c]	(10[c])	9[c]	6[c]	8[c]	8[c]
Total					49	(100)	(100)	133	185	(200)
Regional Meetings										
Southeastern									52	[b]
Southwestern					(35)	43	50	88	85	100
Northwestern							50			78
Others					[b]	[b]	97	[b]	[b]	(20)
Total					(35)	43	197	88	137	198
Total papers presented	(60)	(60)	(70)	(70)	164	267	441	465	581	563

1951–1960 Waiting

	1951	52	53	54	55	56	57	58	59	60
Division Symposia										
National Colloid	24	31	29	30	38	62	28	34	32	29
National Organic	11	—	12	—	12	—	12	—	12	—
Christmas Chem Eng	20	20	14	16	13	16	12	22	16	12
Summer Analytical	15	13	20	9	11	19	16	12	14	21
Summer Medicinal	—	16	—	13	—	17	—	15	—	20
Physical & Inorganic	—	23	27	28			23	24		27
Rubber	—	50	16	18	54	26	24	35	38	18
Others		18	15		8	58		41		23
Total	70	171	133	114	136	198	115	183	112	150
Local Sections										
Pittsburgh Analytical	(100)	(100)	127	122	183	187	131	152	160	—
Delaware Chemistry	(25)	(25)	23	19	32	32	31	52	43	—
Others	(50)	(50)	45	76	110	33	60	44	104	—
Total	175	175	195	217	325	252	222	248	307	387
Meetings-in-Miniature	7[c]	6[c]	7[c]	8[c]	11[c]	4[c]	4[c]	7[c]	5[c]	7[c]
Total	(250)	(250)	287	210	296	192	168	291	238	296
Regional Meetings										
Southeastern	90	(100)	201	190	103	187	111	118	119	—
Southwestern	116	124	[d]	117	99	[d]	114	122	214	—
Northwestern	64	64	68	58	65	81	112	66	96	—
Others	16	16		139	54	449	63	211	61	—
Total	286	304	269	504	321	617	400	517	490	480
Total papers presented	781	900	884	1045	1078	1259	905	1239	1147	1313

presentation media—chemical papers into national meetings in the 1890's and analytical papers into sectional symposia in the 1940's. Once the demand has been met, however, the rate slows down to the 5% or so that more nearly reflects the rate of increase of supply of papers. Intermediate rates of 10 to 20% result when popular types of meetings get more than their share of papers. Rates around 10% could mean taking over most of the rising supply, whereas 20% could mean cutting into other meetings.

Remembering that meetings provide a forum for an exchange between speaker and audience, numbers of papers are the supply aspect of a problem in supply and demand. Figure 3 shows that the ratio of meeting registrants to papers has fluctuated widely over the years. From 4 to 5 to 8 before World War II, the ratio climbed over 10 and then above 15 in the 1940's as audiences increased and papers did not. It remained at 8 and 7 for nearly 20 years thereafter, but has now dropped to 5. This low ratio is not a

Table II. Continued

1961–1970 Growth	1961	62	63	64	65	66	67	68	69	70
Division Symposia										
National Colloid	36	59	39	22	45	59	36	67	65	—
National Organic	12		12		10		11		10	
Christmas Chemical Engineering	11	13	25	11	16	20	18	13	10	—
Summer Chemical Engineering			12	13	8	20	18	16	12	—
Summer Analytical	14	14	17	14	14	28	13	13	12	—
Summer Medicinal		23		25		18		13		—
Summer Physical	[b]	28	23		19	25	—	—		—
Summer Inorganic	[b]			12	[b]	8		—		—
Biennial Polymer		18		13		20		12		—
Rubber	21	63	35	39	93	53	48	46	97	—
Others	(10)	56	0	0	0	14	72	120	—	—
Total	104	274	163	149	205	265	216	300	206	(250)
Local Section Symposia										
Pittsburgh Analytical	222	185	226	200	200	260	294	300	300	314
Delaware Science	37		48		42		7		—	
Eastern Analytical	51	55	56	66	8	92	85	100	80	87
Midwest Chemical	25	24		70						
Southeast Texas Hydrocarbon	8		8			10				
Joint Technical				(10)	11	11	12			
Others	14	24	14	9	11	0	8	6	6	26
Total	357	288	352	355	272	373	406	406	386	427
Meetings-in-Miniature	3[c]	2[c]	3[c]	4[c]	4[c]	3[c]	1[c]	4[c]	4[c]	3[c]
Total	106	90	82	150	128	202	90	110	87	66
Regional Meetings										
Southeastern	241	206	230	171	317	216	372	243	339	700
Southwestern	[d]	210	220	184	[d]	218	242	369	228	[d]
Northwestern	[b]	119	29	88	133	155	127	153	232	191
Oklahoma Tetra	[b]		52	62	62	72		53	64	
Metropolitan			131	128	144				170	94
Midwestern					138	155	155	161	155	141
Western					178	89	248	114	328	221
Great Lakes						112		105	163	109
Middle Atlantic						219	257	301	308	311
Northeast								260		225
Central								177		150
Others	85	138		52						
Total	326	673	662	685	972	1196	1401	1936	1987	2142
Total papers presented	893	1325	1259	1339	1577	2036	2113	2752	2666	2885

[a] Numbers in parentheses are estimates. [b] Meeting presumably held, but no information located. [c] Numbers of meetings, not papers. [d] Included in Southeastern.

characteristic of national meetings alone, as recent regional meetings have averaged below 4. Clearly the demand for papers has switched from low to high and back to low over the past 40 years.

Divisions of the ACS fall rather well into three large classes: those dealing solely with the chemical disciplines, those sharing subject-matter areas with other disciplines, and those that are concerned with materials.[1] In today's terminology, the materials group would be classified as those concerned with mission research. Distribution of papers among these three classes since 1900 is shown in Figure 4. At first, papers were 80% chemical and 20% mission, but during the first quarter of the century, shared papers grew to 20% and mission papers gained another 20%. Since 1925, however, the trends have reversed: chemical papers rose from less than 40% to nearly 60%, at the expense of mission papers until 1955, and at the expense of shared papers thereafter.

Even a cursory examination of programs of ACS meetings other than national also shows a preponderance of papers

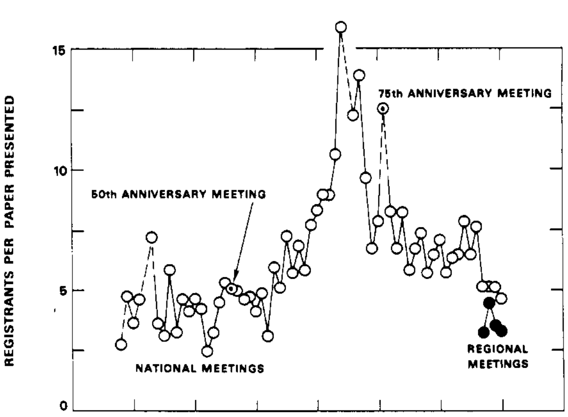

Figure 3. Meeting registrants per paper presented

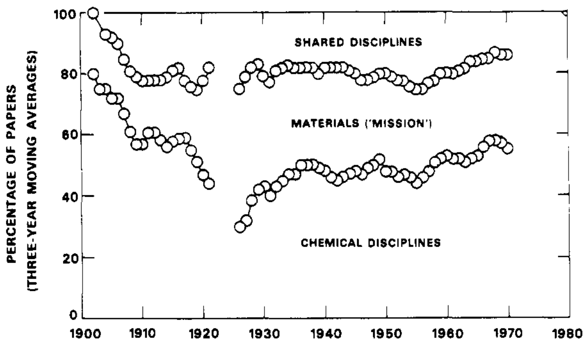

Figure 4. Distribution of papers among classes of divisions

in the chemical disciplines. Mushrooming regional meetings account for more than all others combined, and a further analysis of these is under way. Clearly, chemistry has grown long on papers, and longest on papers in the chemical disciplines, rather than in interdisciplinary areas or in mission research. The benefits of presentation before publishing would seem to be lessening for the researcher, just as it already has for the audience, judging from the diminishing numbers who now attend.

Levelling off of federal support of research will have pronounced effects upon presentation of papers at meetings. Nearly all curves bend downwards over the past two years. How far they drop will depend upon the opposing effects of efficiency and inflation on the conduct of graduate research. The figures will deserve close study, for upon a correct analysis will depend the soundness of Society policy for its second hundred years.

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Assessing New Technology*

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Effective assessment of new technology requires an ability to foretell where that technology is leading and to analyze how it will impinge upon society and the over-all environment. Yet technological forecasting is an unproved discipline, while indicators of social change and standards or goals against which social progress can be measured are lacking for the most part. Technology assessment obviously must be broadly multidisciplinary. It seems no less certain that it will put new burdens on the handling of scientific information and create a demand for more information than is now generally available on the way technology interacts with society as a whole.

About eight years ago, in speaking to a gathering of distinguished scientists, President Kennedy commented: "Every time you scientists make a major invention, we politicians have to invent a new institution to cope with it." That pretty well sums up the idea behind technology assessment, a concept now increasingly in vogue.

Technology assessment, in theory at least, is an idea that seems easy to understand and difficult to fault. It is a reasoned response to the stress that a rapidly changing and expanding technology puts on our complex and increasingly industrialized, urbanized, and densely populated society. It is an attempt at making the process of coping with innovation and technological development more systematic and rational. It would do this by putting the machinery needed for the task into motion not after a new invention has been thrust upon an unsuspecting world but simultaneously with that event.

There are other ways to look at the technology assessment concept, as well: It can be viewed as a mixture of early warning signals and visions of opportunity; as a device for protecting man from his own technological creativity; as a formal mechanism for allocating scientific resources, setting technological priorities, and seeking more benign alternatives for technologies already in use; and as an attempt to control and direct emerging technologies so as to maximize the public benefits while minimizing public risks.

What could appear less controversial?

No wonder, then, that the idea has caught on or that it is winning over more and more people, especially on Capitol Hill and within some of the federal agencies, in the academic world, or from public interest groups, who are anxious to try to put it to practical work—and the sooner the better. They are convinced that if we don't try it, not only will many of our present problems become deeper but we will be faced with an expanding array of newly emerging problems which will only make those of today pale in comparison.

Just what would be the best way to implement technology assessment is not quite clear, of course. While we are swept up in the onrush of technological change, we don't

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