extraction apparatus with petroleum ether. The petroleum ether extract was concentrated to dryness *in vacuo* at 50° C. The residue was taken up in 200 ml. of acetone and precipitated with 800 ml. of a 1% solution of digitonin (3) in ethanol. The sterol digitonide was collected on a Büchner funnel and washed with chloroform, ethanol and ether. The yield was 9 Gm.

Preparation of Sterol Acetate.—The sterol acetate (4) was obtained by refluxing the digitonide with 60 ml. of acetic anhydride for 2 hours. The acetate separated from the cooled solution and was recrystallized from acetic anhydride until a constant melting point was obtained. The product was dried in an Abderhalden drier for 4 hours at 100° C. and 4 mm. The final yield was 1.2 Gm. The following properties were observed:

Melting point—121.8–123° C. A mixed melting point with a known sample of phytosterol acetate gave no depression.

Rotation $[\alpha]_D^{25}$——33.3 in U. S. P. chloroform where C = 0.1 Gm. in 10 ml.

Color reactions—Positive test with Whitby's test B; Whitby and Salkowski; Liebermann and Burchard; Rosenheim and Page.

Preparation of Free Sterol.—The free sterol was obtained by refluxing 0.7 Gm. of sterol acetate with 50 ml. of a 4% solution of potassium hydroxide in 85% ethanol. The sterol crystallized from the solution upon cooling. It was recrystallized from absolute ethanol until a constant melting point was obtained. The product was dried in the Abderhalden drier for 4 hours at 100° C. and 4 mm. The yield was 0.6 Gm. of the purified sterol. The following properties were observed:

Melting point—136.7–137.7° C. A mixed melting point with known phytosterol gave no depression.

Rotation $[\alpha]_D^{25}$——32.7 in U. S. P. chloroform where C = 0.1 Gm. in 10 ml.

Color reactions—Positive test with Whitby's test B; Whitby and Salkowski; Liebermann and Burchard; Rosenheim and Page.

Preparation of Sterol Benzoate.—The sterol benzoate (5) was prepared by dissolving 0.1 Gm. of the sterol in 4 ml. of anhydrous pyridine and then adding 1 ml. of benzoyl chloride. The mixture was shaken and then warmed. The reaction product was poured into 10 ml. of water and shaken. The supernatant liquid was decanted and the residue stirred with 5 ml. of 5% sodium carbonate. The precipitate was filtered on a Büchner funnel and recrystallized from absolute ethanol until a constant melting point was obtained.

Melting point—146–147.2° C. A mixed melting point with a known sample of phytosterol benzoate gave no depression.

From these constants it is apparent that the sterol is phytosterol.

The sterol from the fruit was obtained from the non-saponifiable portion of the kernel. This sterol was found to be identical with the sterol from the buds, since its derivatives had the same constants as listed above.

SUMMARY

A sterol has been isolated from the buds and the mature fruit of the tung tree and identified as phytosterol.

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Pharmaceutical Emulsions. IV. Mixtures of Acacia and Tragacanth as Emulsifying Agents*,†

*By William J. Husa‡ and Charles H. Becker***

INTRODUCTION

In previous papers (1, 2, 3) detailed studies were made of the Continental and English methods of making emulsions; these older methods of emulsification were compared in efficiency with the use of various mechanical stirrers and a hand homogenizer for making emulsions. The present investigation is devoted to a study of acacia-tragacanth mixtures as emulsifying agents, using various methods of emulsification.

EXPERIMENTAL

Materials Used.—The oils selected for study were cod liver oil, linseed oil, castor oil and heavy mineral

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oil; the oils were of U. S. P. quality. Powdered acacia and powdered tragacanth of U. S. P. quality were employed. One-tenth per cent sodium benzoate was added to the distilled water to prevent mold growth in the emulsions while standing for observation.

For viscosity determinations by the steel ball method, Nessler tubes, 30.5 cm. in length and 1.7 cm. in internal diameter, were employed. Steel balls, 0.317 cm. (1/8 inch) and 0.634 cm. (1/4 inch) respectively, in diameter, were used. The 1/8-inch steel balls weighed approximately 0.13 Gm. and the 1/4-inch steel balls weighed approximately 1.04 Gm.

Methods.—The general methods employed were the same as described in a previous paper (1).

In the tables "Oil Sep." is used to indicate oil separation. The following abbreviations are used to indicate the average size of the oil globules.

A—Average diameter less than 2.5 microns.
B—Average diameter from 2.5 to 4 microns.
C—Average diameter from 4 to 6 microns.
D—Average diameter more than 6 microns.

In the following work, unless otherwise specified, 60 cc. portions of 12½% oil emulsions were prepared using a porcelain pestle, 15.0 cm. in length and 4.5 cm. in diameter at the base, and a No. 1 wedgwood mortar.

Variation in Proportion of Tragacanth and Acacia (Continental Method of Emulsification).—The acacia and the tragacanth were first triturated with the 4 parts of oil, and then the 2 parts of water was added all at once. The resulting primary emulsion was triturated for 5 minutes, and the remainder of the water was added gradually with constant trituration. The effect of variation in proportion of tragacanth and acacia is given in Table I.

Results of Table I show that a decrease in the proportion of acacia with a corresponding increase in the proportion of tragacanth caused an increase in the size of the oil globules and produced less stable emulsions. When using acacia alone, the emulsions were whiter in appearance and showed less creaming (1).

Variation in Proportion of Acacia Keeping Tragacanth Constant (Continental Method of Emulsification).—The proportion of tragacanth (0.1 part) was kept constant throughout, but the proportion of acacia was varied. The emulsions were prepared in the same manner as described in the preceding experiment. The effect of variation in proportion of acacia, keeping tragacanth constant, is given in Table II.

Results of Table II show that tragacanth did not aid acacia in stabilizing the emulsions. When using acacia alone, the emulsions were whiter in appearance, showed less creaming and the average size of the oil globules was smaller (1).

Variation in Proportion of Tragacanth Keeping Acacia Constant (Continental Method of Emulsification).—The proportion of acacia (1 part) was kept constant throughout, but the proportion of tragacanth was varied. The emulsions were prepared in the same manner as the emulsions in Table I. The results are given in Table III.

Results of Table III show that a rather high proportion of tragacanth was necessary in most in-

Table I.—Variation in Proportion of Tragacanth and Acacia

(Continental Method)

		Cod Liver Oil		Linseed Oil		Castor Oil		Mineral Oil	
Parts of Tragacanth[a]	Parts of Acacia[a]	Appearance of Emulsion 3 Hours	Average Size of Oil Globules	Appearance of Emulsion	Average Size of Oil Globules	Appearance of Emulsion 3 Hours	Average Size of Oil Globules	Appearance of Emulsion 3 Hours	Average Size of Oil Globules
0.01	0.9	Stable	*A*	Creaming	*D*	Creaming	*A*	Stable	*A*
0.02	0.8	Creaming	*B*	Creaming	*D*	Creaming	*A*	Creaming	*B*
0.03	0.7	Creaming	*B*	Creaming	*D*	Creaming	*B*	Creaming	*C*
0.04	0.6	Creaming	*B*	Oil Sep.	*D*	Creaming	*B*	Creaming	*D*
0.05	0.5	Creaming	*D*	Oil Sep.	*D*	Creaming	*D*	Creaming	*D*
0.06	0.4	Creaming	*D*	Oil Sep.	*D*	Creaming	*D*	Creaming	*D*
0.07	0.3	Creaming	*D*	Oil Sep.	*D*	Creaming	*D*	Creaming	*D*

[a] Number of parts of gum used for 4 parts of oil and 2 parts of water.

Table II.—Variation in Proportion of Acacia Keeping Tragacanth Constant

(Continental Method)

		Cod Liver Oil		Linseed Oil		Castor Oil		Mineral Oil	
Parts of Tragacanth[a]	Parts of Acacia[a]	Appearance of Emulsion 3 Hours	Average Size of Oil Globules	Appearance of Emulsion 3 Hours	Average Size of Oil Globules	Appearance of Emulsion 3 Hours	Average Size of Oil Globules	Appearance of Emulsion 3 Hours	Average Size of Oil Globules
0.1	1.0	Creaming	*D*	Creaming	*D*	Stable	*A*	Creaming	*C*
0.1	0.8	Creaming	*D*	Creaming	*D*	Creaming	*C*	Creaming	*C*
0.1	0.6	Creaming	*D*	Creaming	*D*	Creaming	*D*	Creaming	*D*
0.1	0.4	Creaming	*D*	Creaming	*D*	Creaming	*D*	Creaming	*D*
0.1	0.2	Creaming	*D*	Creaming	*D*	Creaming	*D*	Creaming	*D*

[a] Number of parts of gum used for 4 parts of oil and 2 parts of water.

Table III.—Variation in Proportion of Tragacanth Keeping Acacia Constant

(Continental Method)

Parts of Tragacanth[a]	Parts of Acacia[a]	Cod Liver Oil: Appearance of Emulsion 3 Hours	Cod Liver Oil: Average Size of Oil Globules	Linseed Oil: Appearance of Emulsion 3 Hours	Linseed Oil: Average Size of Oil Globules	Castor Oil: Appearance of Emulsion 3 Hours	Castor Oil: Average Size of Oil Globules	Mineral Oil: Appearance of Emulsion 3 Hours	Mineral Oil: Average Size of Oil Globules
0.1	1.0	Creaming	*D*	Creaming	*D*	Stable	*A*	Creaming	*C*
0.2	1.0	Creaming	*D*	Creaming	*D*	Creaming	*D*	Creaming	*D*
0.3	1.0	Creaming	*D*	Creaming	*D*	Stable	*D*	No emulsion formed	
0.4	1.0	Stable	*D*	Stable	*D*	Stable	*D*	No emulsion formed	

[a] Number of parts of gum used for 4 parts of oil and 2 parts of water.

stances to yield emulsions which were stable during a 3-hour period of standing. When using acacia alone, the emulsions were whiter in appearance, showed less creaming and the average size of the oil globules was smaller (1).

A series of emulsions was also prepared in another way, using the Continental method of emulsification and the same proportions of tragacanth and acacia as employed in the preceding experiment. The one part of acacia was triturated well with the 4 parts of oil, and then the 2 parts of water was added all at once. The resulting primary emulsion was triturated for 5 minutes. A mucilage of tragacanth, containing 0.1% sodium benzoate and 0.187 Gm. of tragacanth in 10 cc. of the mucilage was added to the primary emulsion. The mixture was triturated for about a half minute, and the remainder of the water was added gradually with constant trituration.

With reference to the rate of creaming within a 3-hour period of standing, the results were the same as in Table III, although the average size of the oil globules was smaller and the emulsions were whiter when using this method of preparation.

Variation in Proportion of Tragacanth Keeping Acacia Constant (English Method of Emulsification).—A mucilage of tragacanth containing 0.1% sodium benzoate and 0.187 Gm. of tragacanth in 10 cc. of the mucilage was used. Mucilage of acacia U. S. P. was employed. In making the emulsions the oil was added in about one cc. portions to the mixture of mucilages, triturating each portion of oil until well emulsified before making the next addition. After adding all of the oil, the final mixture was triturated for 5 minutes, and then the remainder of the water was added gradually with constant trituration. The results are given in Table IV.

Results of Table IV show that tragacanth did not aid in stabilizing the emulsions. An increase in the proportion of tragacanth caused an increase in the size of the oil globules and produced less stable emulsions. When using acacia alone, the emulsions were whiter in appearance, showed less creaming, and the average size of the oil globules was smaller (2).

Use of Homogenizer.—In this series of emulsions, a mucilage of tragacanth containing 0.1% sodium benzoate and 0.187 Gm. of tragacanth in 10 cc. of the mucilage and U. S. P. mucilage of acacia were employed. In all cases, the 4 parts of oil, mucilage of acacia, mucilage of tragacanth and water were placed in the hand homogenizer in the order named. The whole mixture was passed through the homogenizer three times. Results of use of the hand homogenizer are given in Table V.

Results of Table V show that in the case of cod liver oil, linseed oil and mineral oil, a mixture of tragacanth and acacia gave products which showed less creaming than when using acacia alone (3). Likewise, in the case of these oils when using 0.1 part of tragacanth with or without the addition of acacia the emulsions were stable over a period of 5 days of standing. With castor oil, the use of tragacanth in combination with acacia did not appear to be of any advantage.

Table IV.—Variation in Proportion of Tragacanth Keeping Acacia Constant

(English Method)

Parts of Tragacanth[a]	Parts of Acacia[a]	Cod Liver Oil: Appearance of Emulsion 3 Hours	Cod Liver Oil: Average Size of Oil Globules	Linseed Oil: Appearance of Emulsion 3 Hours	Linseed Oil: Average Size of Oil Globules	Castor Oil: Appearance of Emulsion 3 Hours	Castor Oil: Average Size of Oil Globules	Mineral Oil: Appearance of Emulsion 3 Hours	Mineral Oil: Average Size of Oil Globules
0.01	1.0	Creaming	*A*	Creaming	*D*	Stable	*B*	Creaming	*B*
0.03	1.0	Creaming	*C*	Creaming	*D*	Creaming	*D*	Creaming	*D*
0.07	1.0	Creaming	*D*	Oil Sep.	*D*	Creaming	*D*	Creaming	*D*
0.10	1.0	Creaming	*D*	Oil Sep.	*D*	Oil Sep.	*D*	Oil Sep.	*D*

[a] Number of parts of gum used for 4 parts of oil and 2 parts of water.

Table V.—Use of Homogenizer

Parts of Tragacanth[a]	Parts of Acacia[a]	Cod Liver Oil: Appearance of Emulsion 3 Hours	Cod Liver Oil: Average Size of Oil Globules	Linseed Oil: Appearance of Emulsion 3 Hours	Linseed Oil: Average Size of Oil Globules	Castor Oil: Appearance of Emulsion 3 Hours	Castor Oil: Average Size of Oil Globules	Mineral Oil: Appearance of Emulsion 3 Hours	Mineral Oil: Average Size of Oil Globules
0.1	1.0					Stable	*B*	Stable	*B*[b]
0.05	1.0					Creaming	*B*	Stable	*B*
0.01	1.0					Creaming	*B*	Creaming	*B*
0.005	1.0					Creaming	*B*	Creaming	*B*
0.1	0.6	Stable	*A*[b]	Stable	*A*[b]				
0.05	0.6	Stable	*A*	Stable	*A*				
0.01	0.6	Stable	*A*	Stable	*A*				
0.005	0.6	Stable	*A*	Stable	*A*				
0.1	0.1	Stable	*A*[b]	Stable	*A*[b]	Creaming	*B*	Stable	*C*[b]
0.05	0.1	Stable	*A*	Stable	*A*	Oil Sep.	*D*	Stable	*C*
0.01	0.1	Stable	*A*	Stable	*A*	Oil Sep.	*D*	Creaming	*C*
0.005	0.1	Creaming	*A*	Creaming	*A*	Oil Sep.	*D*	Creaming	*C*
0.1	0.013	Stable	*A*[b]	Stable	*A*[b]	Oil Sep.	*D*	Stable	*C*[b]
0.05	0.013	Stable	*A*	Stable	*A*	Oil Sep.	*D*	Stable	*C*
0.01	0.013	Stable	*A*	Stable	*A*	Oil Sep.	*D*	Creaming	*D*
0.005	0.013	Creaming	*A*	Creaming	*A*	Oil Sep.	*D*	Creaming	*D*
0.1	0.0	Stable	*A*[b]	Stable	*A*[b]	Oil Sep.	*D*	Stable	*C*[b]
0.05	0.0	Stable	*A*	Stable	*A*	Oil Sep.	*D*	Stable	*C*
0.01	0.0	Oil Sep.	*B*	Stable	*B*	Oil Sep.	*D*	Oil Sep.	*D*
0.005	0.0	Oil Sep.	*B*	Creaming	*B*	Oil Sep.	*D*	Oil Sep.	*D*

[a] Number of parts of gum used for 4 parts of oil and 2 parts of water.
[b] Emulsions were stable over a period of 5 days of standing.

Viscosity Measurements on Mucilages.—In view of the fact that the addition of tragacanth retarded creaming in certain oil-water-acacia emulsions made in the homogenizer, the question arose as to how this effect was to be explained. It has been commonly thought that the addition of tragacanth in such cases retards creaming by increasing the viscosity of the emulsion. However, Rowson (4) has reported that the viscosity of mixtures of mucilages of acacia and tragacanth is less than that of either of the mucilages alone.

In the present study, viscosity measurements were made on various mucilages to test the conclusions of Rowson. Viscosity measurements were also made on emulsions containing mixtures of acacia and tragacanth, in order to determine whether or not the beneficial effect of tragacanth may be ascribed to viscosity or whether it is due to some other factor.

In the preparation of the mucilage of acacia, 500 Gm. of acacia was dissolved in 1000 cc. of water by triturating in a mortar. One-tenth per cent sodium benzoate was added as a preservative. When making the mucilage of tragacanth, using 18.75 Gm. of tragacanth for 1000 cc. of water, the water was first heated to boiling and then the gum was added. The mixture was allowed to stand, shaking frequently, until a uniform mucilage resulted. Likewise, 0.1% sodium benzoate was added.

Using a stop watch, viscosity measurements were made by noting the time in seconds, required for a steel ball, 1/4 inch in diameter, to descend through a 30 cm. column of the mucilage in a Nessler tube. The mixtures of mucilages were made by measuring the mucilages in a glass-stoppered, graduated cylinder and shaking thoroughly. The mixtures of mucilages were allowed to stand for several minutes before making viscosity measurements. The measurements were taken at 25° C. The viscosities of acacia and tragacanth mucilages and mixtures of these mucilages are given in Table VI.

Table VI.—Viscosities of Acacia and Tragacanth Mucilages and Their Mixtures

Per Cent of Mucilages Expressed in Volume: Tragacanth	Acacia	Viscosity in Seconds: 0[a]	3 Days[a]	7 Days[a]
100	0	19.1	19.2	23.0
90	10	0.6	0.6	0.6
75	25	0.4	0.4	0.4
50	50	0.4	0.4	0.4
25	75	0.7	0.7	0.8
10	90	1.2	1.2	1.4
0	100	2.0	2.0	2.2

[a] Age of mucilage in days.

The results of Table VI show that when mucilages of tragacanth and acacia are mixed in any proportion, the viscosity of the resulting mixture is less than that of either mucilage alone. When mucilages of tragacanth and acacia were mixed, there was separation into two layers within several hours in all cases except when 90 parts of mucilage of acacia was mixed with 10 parts of mucilage of tragacanth. Homogenization of the mucilage did not prevent separation. The layer on top had the appearance of mucilage of tragacanth, and the layer on the bottom appeared to be mucilage of acacia. These findings are in accord with Rowson's results (4). Some of the mucilages showed an increase in viscosity after several days of standing.

Viscosities of Emulsions.—Viscosity measurements were made on emulsions, using the same method of determining viscosity as described in the preceding experiment. In this work, a steel ball 1/8 inch in diameter was employed.

The viscosities of emulsions are given in Table VII.

Table VII.—Viscosities of Cod Liver Oil Emulsions

Parts of Acacia[a]	Parts of Tragacanth[a]	Method of Preparation	Appearance of Emulsion 3 Hours	Average Size of Oil Globules	Viscosity in Seconds
1.0	0	Mortar	Stable	*A*	0.6
1.0	0.1	Mortar	Creaming	*A*	0.6
1.0	0.4	Mortar	Stable	*A*	1.8
1.0	0.1	Mortar	Creaming	*D*	0.6
1.0	0.4	Mortar	Stable	*D*	1.0
1.0	0	Homogenizer	Stable	*A*	0.6
0	0.1	Homogenizer	Stable[b]	*A*	0.8
0	0.4	Homogenizer	Stable[b]	*D*	26.0
1.0	0.1	Homogenizer	Stable[b]	*A*	0.8
1.0	0.4	Homogenizer	Stable[b]	*A*	17.5
1.0	0.4	Mortar and homogenizer	Stable	*A*	8.0

[a] Number of parts of gum used for 4 parts of oil.
[b] Emulsion was stable during a period of standing of seven days.

The results of Table VII showed that tragacanth in combination with acacia caused little increase in the viscosity of the emulsions when made by the mortar method. All emulsions made by this method showed creaming within a day. When using a hand homogenizer, there was a marked increase in viscosity with an increase in the amount of tragacanth with or without the use of acacia. All emulsions containing tragacanth, with or without acacia, were stable during a period of one week of standing when the entire preparation was homogenized.

DISCUSSION OF RESULTS

Tragacanth is generally considered inferior to acacia as an emulsifying agent as it gives emulsions which are not as white as similar emulsions made with use of acacia.

Smith and Hazley (5) showed that a mixture of tragacanth and acacia was a more efficient emulsifying agent than either gum alone. It has been commonly thought that the addition of tragacanth in such cases retards creaming by increasing the viscosity of the emulsion. However, it was reported by Rowson (4) that the viscosity of mixtures of mucilages of acacia and tragacanth is less than that of either of the mucilages alone. The explanation put forth by Rowson is that the addition of mucilage of acacia to mucilage of tragacanth results in a dehydration of the gel masses of tragacanth and their deposition as white floccules. The results of the present study verified the conclusions of Rowson as applied to mixtures of mucilages.

In the present investigation, viscosity determinations were carried out on emulsions containing mixtures of acacia and tragacanth. When the emulsions were made by means of a mortar and pestle, it was necessary to add tragacanth in rather high proportions before an increase in viscosity was noted. However, when the emulsions were prepared by use of a hand homogenizer, the viscosity of the emulsions was markedly increased when tragacanth was present either alone or with acacia. Smith and Hazley (5) also found that tragacanth increased the viscosity of emulsions made with acacia. It appears that in an emulsion much of the acacia is adsorbed as a film on the oil globules and thus does not have the marked dehydrating effect on tragacanth gels it would have if present in solution in the continuous phase (4).

With aid of the hand homogenizer, the use of as little as 0.013 part of acacia along with 0.1 part of tragacanth, for four parts of oil, yielded emulsions which were whiter than when using tragacanth alone. The emulsions showed much less creaming than when using acacia alone. It was found satisfactory to place the oil, the separate mucilages and the water in the homogenizer in the order named and then to proceed with homogenization of the entire mixture. The results held true for cod liver oil, linseed oil and mineral oil but not for castor oil; with the latter oil the use of tragacanth in combination with acacia did not appear to be of any advantage.

Viscosity measurements on cod liver oil emulsions showed that a high viscosity was not necessary to give an optimum product. In some instances, an emulsion of high viscosity showed more creaming than an emulsion of lower viscosity. From the results obtained, it appears likely that tragacanth, when used in making emulsions of oils with aid of a homogenizer, exerts an effect as an emulsifying agent by some means other than mere viscosity. In this connection, it is of interest to note the statement made by Serrallach, Jones and Owen (6) regarding an emulsion of cod liver oil containing three emulsifiers, *i. e.*, tragacanth, acacia and agar. These authors state that tragacanth gives a quick film formation, acacia acts as a film strengthener and agar increases viscosity.

SUMMARY

A study was made of the emulsification of fixed oils and mineral oil by various methods. In the preparation of emulsions by use of a hand homogenizer, it was found that a mixture of acacia and tragacanth gave better results than either gum alone. The mixture of gums gave emulsions which were whiter than emulsions made with tragacanth alone, and showed less creaming than emulsions made with acacia alone. These results held true for cod liver oil, linseed oil and mineral

oil, but not for castor oil. Experiments showed that the use of tragacanth in combination with acacia was of no advantage if the emulsions were made with a mortar and pestle. From the results of viscosity determinations, it appears that the beneficial results obtained by addition of tragacanth in certain cases are due to factors other than viscosity alone.

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Book Reviews

Chemotherapie backterieller Infektionen, by G. DOMAGK and C. HEGLER; the first volume in a series of *Beiträge zur Arzneimitteltherapie* edited by L. LENDLE and R. SCHOEN. 185 pp. Hirzel, Leipzig, 1940.

This book by Domagk, the discoverer of prontosil, and by a clinician, Hegler, concerns bacterial chemotherapy with sulfanilamide derivatives and azo dyestuffs. The first half is by Domagk, reviewing the chemistry and experimental chemotherapy of the compounds; the second half by Hegler reviews clinical observations. Mention is made of a sulfanilamide derivative called Mesuden (chemical constitution not disclosed), synthesized by Klarer, effective in animals against *Vibrion septique*, *B. oedematiens* (Novy's bacillus) and the Welch-Fraenkel bacillus (*B. phlegmones emphysematosae*). From book review in *Arch. Pharm. og Chemi.*, 47 (1940), 641.—C. S. L.

Accepted Dental Remedies. 6th Edition. Council on Dental Therapeutics. 317 pages, $4^1/_8$ x $7^1/_4$. 1940. Chicago: American Dental Association, $1.00.

This volume is published by the American Dental Association and it serves the same general purpose as the New and Nonofficial Remedies edited by the American Medical Association. Only those drugs which are considered of greatest importance in dentistry are included; and the substances which are acceptable to the American Dental Association are listed together with the names of the manufacturers.

A number of general articles have been added. Here the pharmacist has an access to many dental formulas which should result in a better coöperation between pharmacists and dentists.—A. G. D.

Family Expenditures for Medical Care. Miscellaneous Publication No. 402. U. S. Department of Agriculture in coöperation with the Work Projects Administration, 241 pages, 1941. The Superintendent of Documents, Washington, D. C. Price, 30 cents.

This publication, which is one of a series of consumer purchases studies, is a report of family expenditures for medical care written from data gained in the large scale, government conducted studies. It shows how much farm, village and small city families in different income levels, various localities and a variety of occupations spend for medical care. It includes not only the professional services of physicians, dentists and specialists, but also other items as medicines, drugs, eye-glasses and hospitalization.

The publication contains much of interest to pharmacists, everyone of whom should have a copy in their possession.—A. G. D.

Useful Drugs. Edited by ROBERT A. HATCHER. 12th Edition, 268 pages, $4^1/_4$ x $7^1/_8$, 1940. Chicago: American Medical Association. Price, $.75.

The American Medical Association has published a pocket-sized booklet to provide the physician with information of drugs which are considered very important in the medical practice. In addition to the incompatibilities, properties, doses, uses and important preparations, descriptions are also given for some official and N. N. R. drugs. Only drugs which would increase the interest of the physician in prescribing drugs of proven therapeutic effects are included. This booklet should also prove of value to pharmacists.—A. G. D.

Catalysis, Inorganic and Organic. By SOPHIA BERKMAN, JACQUE C. MORRELL and GUSTAV EGLOFF. xi + 1130 pages, 6 x 9 in., 1940. Published by Reinhold Publ. Corp., New York. $18.00.

The phenomenon of catalysis is thoroughly reviewed and all phases of catalysis are discussed. In the first half of the book there are chapters on adsorption, inhibitors, carriers, promoters and poisons. Catalytic reactions in inorganic chemistry and the conditions which affect these reactions are also included.

The remaining chapters consider the type reactions of the various catalysts and the applications of catalysts, especially in the petroleum industry. Numerous references are given at the end of each chapter and the catalytic reactions are classified.—A. G. D.