

Clinical review

Comedogenicity of current therapeutic products, cosmetics, and ingredients in the rabbit ear

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Cosmetics continue to be used by acne-prone individuals. Often as more acne develops, more cosmetics are applied. In order to protect against this natural tendency, physicians should provide more patient information on the currently available products and ingredients. This presentation is designed to help in that effort. The data presented were gleaned from the rabbit ear assay, which is not an ideal animal model but is the best we have. If an ingredient is negative in the rabbit ear assay, we feel it is safe on the acne-prone skin. A strong, positive ingredient or cosmetic should be avoided. Ingredient offenders include isopropyl myristate and its analogs, such as isopropyl palmitate, isopropyl isostearate, butyl stearate, isostearyl neopentanoate, myristyl myristate, decyl oleate, octyl stearate, octyl palmitate or isocetyl stearate, and new introductions by the cosmetic industry, such as propylene glycol-2 (PPG-2) myristyl propionate. Lanolins continue to be a problem, especially derivatives such as acetylated or ethoxylated lanolins. Our most troublesome recent finding is the comedogenic potential of the D & C Red dyes. They are universally used in the cosmetic industry, especially in blushers. This may explain the predominance of cosmetic acne in the cheekbone area. All of these D & C Red dyes tested to date, the xanthenes, monoazoanilines, fluorans, and indigoids, are comedogenic. Actually, this is not surprising as they are coal tar derivatives. The natural red pigment, carmine, is noncomedogenic and can serve as a substitute for D & C dyes in blushers. Many finished products are comedogenic. Most troublesome to the dermatologists are the therapeutic tools that we use, such as Liquimat, Retin-A cream, Hytone, Staticin, Sulfoxl, Desquam-X, and Persadox HP cream. These should be reformulated. We have been unable to confirm that precipitated sulfur (U.S.P.) is a potent comedogen in the rabbit ear assay. Clinically, we still find sulfur quite effective as an adjuvant to the benzoyl peroxide therapy for the treatment of acne vulgaris. We would suggest that the bias against sulfur be reconsidered. (*J AM ACAD DERMATOL* 10:96-105, 1984.)

Since the last reports by Kligman and Fulton,¹⁻⁴ several new cosmetics have been introduced and others have left the consumer market. Many of our

suggestions are now outdated. This study is designed to present the current comedogenic status of therapeutic products and cosmetics, in regard both to ingredients and to formulations. As in the 1970s, the cosmetics industry still remains quite vocal in their war on soap and water, in favor of 24-hour exposure to cleansing creams, night moisturizers, astringents, face foundations, and rouges

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Fig. 1. Results with PPG-2 myristyl propionate. A close-up view of the rabbit ear after 2 weeks of exposure to PPG-2 myristyl propionate. Note the marked surface irritation as well as the follicular keratosis. This chemical is being promoted by the manufacturer as a "noncomedogenic" ingredient.



Fig. 2. The control rabbit ear for comparison.

or blushers. Although some of the American population has skin that will tolerate this extensive exposure to cosmetics, others with more sensitive complexions or acne-prone problems will develop either skin irritation or follicular impactions from the continual use of these potential offenders.

We have continued to evaluate therapeutic products and cosmetics and their ingredients with the use of the "rabbit ear" as our experimental model. This model is useful as a screen for both topical skin irritants and follicular irritants. It may take up to 6 months for many commercial preparations to produce problems in human skin, but the rabbit ear is so sensitive that surface erythema and desquamation and/or a follicular keratosis follows the daily application of a test agent in only 2 weeks. Hopefully, the data presented in this paper will make it easier for a clinician and his patient to ferret through the presently available products and ingredients and also understand better future generations of cosmetics. Examples of therapeutic products and cosmetics which have passed this testing and also examples which have performed poorly are reviewed.

METHODS AND MATERIALS

We continue to evaluate cosmetics donated by acne patients, focusing mainly on foundation makeups, liquid coverups, and, more recently, blushers. We have

not attempted a comprehensive survey of the entire range of available products. Commercial preparations are tested as is; if the ingredients are liquids or soft solids, they are also tested in the rabbit ear as is. Powders or hard solids are mixed with propylene glycol or incorporated into an alcohol gel at a dilution of 1:9 for testing. We have developed a colony of New Zealand albino rabbits which genetically have good ears and have provided reproducible results following exposure to acnegens. Yet, there remains possible variation in individual rabbits and in sources and grades of cosmetic ingredients and finished products. Two rabbits are used for each test. One cosmetic or one test ingredient is applied to the internal surface of one ear daily for 2 weeks. The alternate ear serves as a control. Following the 2 weeks, the surface irritation and/or the follicular hyperkeratosis is judged clinically. The results are judged on a scale between 0 and 5. Grade 0 is no increase in visible follicular keratosis; grade 1 to 2 is a visible increase in hyperkeratosis. Grade 3 to 4 is a development of significant comedones. Grade 5 is the presence of more severe comedones throughout the ear, similar to those induced by the application of coal tar. As in our previous studies, a minimal grade of 1 to 2 is not considered significant. However, a grading score of 3 or above is uniformly reproducible and considered positive. In difficult cases with borderline results, the microscopic method of Kligman and Kwong⁵ is employed. The epidermis and attached follicles are stripped from a rabbit ear biopsy after heating at 60° for 2 minutes. The pattern of follicular keratosis is judged microscopically on the same 0 to 5 scale. If the microscopic and clinical findings are not similar, the study is repeated.

A simple screening test for the clinician or his patient to ascertain oil content in cosmetics capitalizes on the ability of an oil to migrate through a paper matrix,

Table I. Scale of comedogenicity in the rabbit ear

	Grading 0-5	Ingredients	Grading 0-5
<i>Cosmetics</i>		<i>Lanolins</i>	
1. <i>Elizabeth Arden</i>		Acetylated lanolin	4
Illusion Foundation	2	Ethoxylated lanolin	3
Ardena Velva Cream Mask	1	Anhydrous lanolin	2
Ardena Moisture Oil	4	Lanolin alcohol	2
2. <i>Revlon</i>		<i>Surfactants and detergents</i>	
Natural Wonder Oil-Free Base	0	Myristyl lactate*	5
Natural Wonder Anti-Acne Spot Cover	4	Isopropyl myristate	5
Ultimate II Transparent Tawny	5	Myristyl myristate	5
Formula 2 Makeup	1	Butyl stearate	4
Formula 2 Blusher	3	Isopropyl isostearate	5
Formula 2 Highlighter	4	Isostearyl neopentanoate	3
3. <i>Allercreme</i>		Isopropyl palmitate	4
Satin Finish	5	Decyl oleate	3
Matte Finish	4	PPG-2 myristyl propionate	5
Velvet Finish	4	Laureth-4*	4
Reflecta	3	Sodium lauryl sulfate	5
4. <i>Noxell</i>		<i>D & C pigments</i>	
Cover Girl Oil Control Makeup	5	D & C Red No. 2*	3
5. <i>Almay Inc</i>		D & C Red No. 4*	2
Pure Beauty Foundation for Oily Skin	0	D & C Red No. 6*	3
6. <i>Helena Rubinstein: Bio Clear</i>	0	D & C Red No. 9*	4
7. <i>Max Factor: Pure Magic Oil Free</i>	4	D & C Red No. 19*	3
8. <i>Jafra: Super Tone Makeup Base</i>	4	D & C Red No. 21*	3
9. <i>Shaklee: Song of the Desert Makeup</i>	5	D & C Red No. 27*	4
10. <i>Mary Kay: Day Radiance</i>	5	D & C Red No. 30*	3
11. <i>Clinique</i>		D & C Red No. 33*	2
Pore Minimizer	0	D & C Red No. 36*	3

The product or ingredient was used "as is" if the agent was a liquid or soft solid. Others (*) were either diluted with mineral oil or incorporated into an alcohol gel at a 10% concentration.

similar to the procedure for paper chromatography of lipids. A thick streak of the test cosmetic is placed on a piece of nonglossy 25% cotton bond paper such as Hammermill bond. Twenty-four hours later, the diameter of the oil migration is examined by holding the paper up to the bright light. The extent of this migration is dependent on the oil concentration in the preparation. This tool has been useful for monitoring the amount of oil present in cosmetics and also for examining the claim of "oil-free" cosmetics.

RESULTS

The rabbit ear continues to be a rapid, effective screening tool for the evaluation of cosmetics and cosmetic ingredients (Table I). Although it may be difficult to separate the minimal reactor such as grade 0-2, grades 3, 4, and 5 are clear-cut and the results are quite uniform. In addition to inducing follicular hyperkeratosis, several of the ingre-

dients (such as propylene glycol-2 (PPG-2) myristyl propionate (Figs. 1 and 2), D & C Red No. 33, and sulfated castor oil) are also quite irritating to the surface skin of the rabbit ear.

To shed more light on the question of the comedogenicity of sulfur, more in-depth studies have been done with precipitated sulfur (U.S.P.). William Schmitt, of Chesebrough-Ponds Inc., provided us with six different samples of precipitated sulfur collected from sources around the world. In testing these, in addition to our own three sources of sulfur, we are unable to find any which produced a reaction in the rabbit ear greater than 2.

The method of lipid chromatography of cosmetics using the 25% cotton bond paper is useful in demonstrating that many cosmetics contain a large fraction of oil (Fig. 3). This is particularly trou-

Table I. *Cont'd*

	Grading 0-5	Ingredients	Grading 0-5
Balance Makeup Base	3	<i>Miscellaneous pigments</i>	
Continuous Coverage	4	Ultramarine Violet*	0-1
Color Rub	5	Iron oxides	0-1
12. Merle Norman		Carmine*	0-1
Aqua Base	5	Chromium hydroxide*	0-1
Warm Blusher	4	Titanium dioxide*	0-1
Liquid Makeup	3	<i>Miscellaneous ingredients</i>	
<i>Moisturizers</i>		Octyl dimethyl PABA	0
Soft Sense Skin Lotion	5	Glycerin	0
Vaseline Intensive Care	4	Propylene glycol	0
Jergens Skin Lotion	3	Precipitated sulfur*	0-2
Crisco	3	Colloidal sulfur	3
Keri Lotion	3	Sulfated castor oil	3
Vaseline Dermatology Formula cream	3	Cetyl alcohol	3
Oil-of-Olay	2	Oleyl alcohol	4
Albolene	0	Kaolin*	1
Mineral oil	0	Hectorite*	1
Petrolatum	0	Carbomer 940*	0
<i>Therapeutic agents</i>		Hydroxypropyl cellulose	1-2
Hytone	5	Polyethylene glycol 300	1
Retin-A Cream	4	Propylene glycol monostearate	4
Staticin	4		
Sulfoxyl	4		
Desquam-X	4		
Van Oxide	4		
Persadox HP Cream	3		
Liquimat	3		
D & C Red No. 40*	4		

The product or ingredient was used "as is" if the agent was a liquid or soft solid. Others (*) were either diluted with mineral oil or incorporated into an alcohol gel at a 10% concentration.

blesome in some cosmetics which claim to be oil-free. This claim often proves to be false in this assay. (See product No. 6 in Fig. 3.)

DISCUSSION

William R. Markland, editor of *Norda Briefs*, a periodic cosmetic industrial review, states, "It would appear self-evident that non-comedogenicity should be the standard for face makeup preparations, face creams and other cosmetics in long-term, continued contact with the skin and especially so in case of products directed toward the teenage user."⁶ Unfortunately, the cosmetic industry still is working toward this goal.

Finished products

Although the rabbit ear is only an animal model, it is the best available tool to mimic follicular keratosis in humans. It is quite useful for

separation of the offenders in a collection of cosmetics which may be causing a problem for a particular patient. For example, one of our patients brought in Elizabeth Arden's Illusion Foundation, Elizabeth Arden's Cream Mask, and Elizabeth Arden's Moisture Oil. Without the rabbit ear assay, it would have been impossible to separate out the offender. The results after 2 weeks indicated that the Ardena Velvet Cream Mask was not a problem (Table I). The main problem was the nighttime Ardena Moisture Oil, which could successfully be eliminated from the daily routine without a loss to the patient's cosmetic elegance.

The results from several of Revlon's cosmetics point up several additional problems. For many years, we had suggested to the patients to use Natural Wonder Oil-Free Base. This cosmetic had originally passed our evaluation and contained no

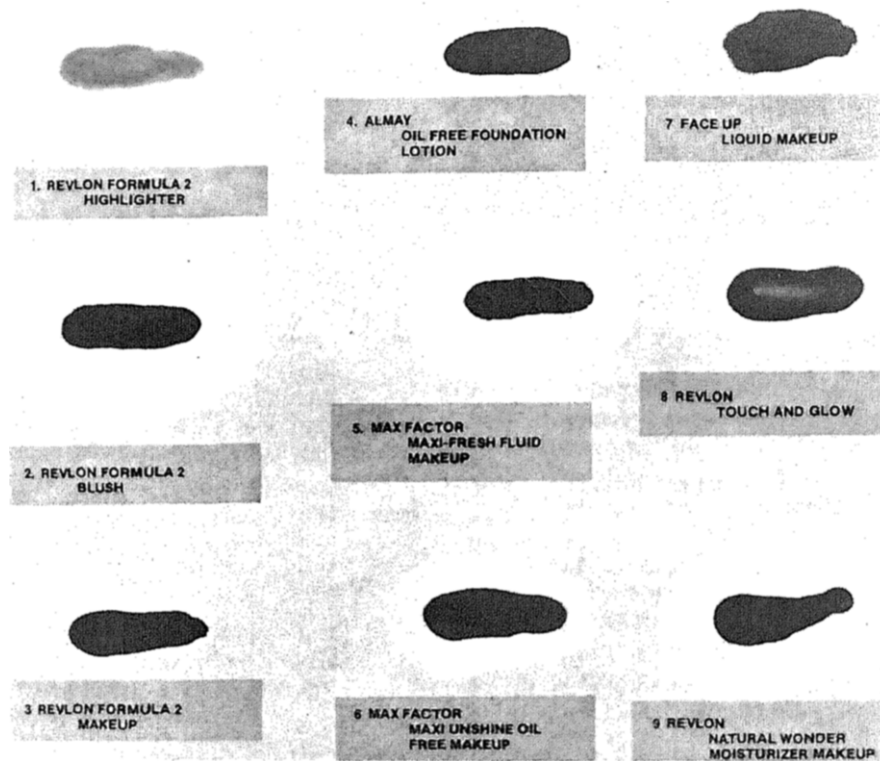


Fig. 3. Chromatography of cosmetics. A thick stream of the cosmetic in question is placed on 25% cotton bond paper. Twenty-four hours later, the resultant migration of oil can be evaluated. The degree of movement is proportional to the concentration of the oil in the formulation.

known offenders. Unfortunately, Revlon decided to drop the product from the market and replace it with Natural Wonder Alive and Free, which contains the offender isostearyl neopentanoate. One must be quite careful in advising patients when finding one product line, such as Natural Wonder, which appears to be satisfactory. For example, even though Natural Wonder Oil-Free Base was acceptable, Natural Wonder Anti-Acne Cover is quite oily and acneogenic.

The cosmetic companies have rarely been consistent throughout their complete product lines. An example might be Revlon's new Formula II Makeup. The foundation makeup in this line is noncomedogenic, but the Formula II Blusher and, especially, the Formula II Highlighter are both quite comedogenic. As yet, dermatologists do not have a complete line that they can offer the patient to make selection simple.

We currently recommend Almay's Pure Beauty

Foundation for Oily Skin and Helena Rubinstein's Bio-Clear for the acne sufferer. The list of ingredients does not contain offenders, and the formulations produce no adverse reaction in the rabbit ear. Unfortunately, it is often difficult to find an Almay Pure Beauty Foundation for Oily Skin on the cosmetic shelf compared to the availability of Almay's Pure Beauty Foundation for Dry Skin. Often, the product ratio in the display is 1 to 10 in favor of the dry skin formula. The unwary consumer may end up with the wrong product, as the dry skin formula contains isostearyl neopentanoate. The patient must be warned repeatedly to search until the product that is marked "for oily skin" is found. Helena Rubinstein's Bio-Clear may not be obviously displayed either. The cosmetic industry should help develop a public awareness campaign so that these types of products are more eagerly sought and, thus, demand more shelf space.

Table II. Problem ingredients used in various cosmetics*

Samples of acceptable cosmetics

1. Almay Inc.: Pure Beauty Foundation Lotion for Oily Skin (Water-Glycerin-Talc)
2. Helena Rubinstein Bio-Clear (water and propylene glycol)
3. Cosmetics composed of simple, loose iron oxide powders

Samples of cosmetics containing unacceptable ingredients

Contain lanolins

1. Clinique Balanced Makeup Base
2. Estée Lauder Fresh Air Makeup Base
3. Elizabeth Arden Believable Color Minimum Oil Makeup
4. Maybelline Brush Blush
5. Coty Glowing Finish

Contain isostearyl neopentanoate

1. Borghese Water Base Makeup
2. Coty Oil-Free Makeup
3. Max Factor Maxi-Unshine Oil-Free Makeup
4. Revlon Natural Wonder Oil-Blotting Makeup

Contain myristyl myristate

1. Cover Girl Oil-Control Makeup
2. Physicians Formula Oil-Free Matte Makeup
3. Revlon Touch and Glow Moisturizing Makeup

Contain isopropyl palmitate

1. Helena Rubinstein Fresh Cover Water-Based Liquid Makeup
2. Bonnie Bell Medicated Makeup
3. Helena Rubinstein Silk Fashion

Contain decyl oleate

1. Revlon Research Group Formula 2 Blusher or Highlighter
2. Cover Girl All Day Water-Base Liquid Makeup

Contain octyl stearate or octyl palmitate or isacetyl stearate

1. Elizabeth Arden Believable Color Minimum Oil Makeup
2. Revlon Research Group Formula 2 Blusher or Highlighter
3. Helena Rubinstein Fresh Cover Water-Based Liquid Makeup

Contain isopropyl myristate

1. Max Factor Maxi-Fresh Fluid Makeup
2. Coty Moisture Retention Makeup
3. Maybelline Creme Makeup
4. Elizabeth Arden Illusion Foundation
5. Allercrème Velvet Finish
6. DuBarry Flatter-Glow
7. Max Factor Ultralucent
8. Almay Pre Beauty Moisturizing Makeup
9. Cover Girl Liquid Moisturizer Makeup

*To make the problem simpler for the acne-prone individual, we have made a list of samples of acceptable cosmetics and cosmetics that contain unacceptable ingredients. These are presented to our patients only as suggestions, but they are useful, as sometimes the ingredient list is difficult to understand.

Samples from the cosmetics that are available through local cosmetic parties (Jafra, Shaklee, and Mary Kay) rated quite high on the comedogenic scale. Unfortunately, the local representative from these companies may focus on the acne sufferers at the party and attempt to convince them that the products may improve their condition when, in reality, the skin may be aggravated by their products. In an attempt to correct this situation, Mary Kay has recently launched an alternate line of products for oily complexions. We have not yet had the opportunity to evaluate them.

In the Clinique line, the Clinique Pore Minimizer is their shake lotion cosmetic. Although results in the rabbit ear are acceptable, we do not currently recommend it for acne patients as the alcohol content in the preparation often makes it too drying, especially if the skin is already dry from acne therapy. The Clinique Balanced Makeup Base and the Continuous Coverage formulations

are more oily and consequently give higher comedogenic results in the rabbit ear assay. The Clinique Color Rub produced a grade 5 score.

We have just begun looking at other classes of cosmetics such as shaving creams, hair conditioners, and shampoos. Lipsticks could also be a problem as they tend to migrate onto the skin and contain comedogenic ingredients. So far, we have tested two lipsticks, and both produced a grade 3 reaction. One wonders if these results could be related to the closed and open comedones often seen around the lips of acne sufferers.

Recently, Crisco has been advocated by many dermatologists as a good moisturizer, especially since it does not contain any detergents or preservatives. However, it is a grade 3 reactor in the rabbit ear, perhaps due to residual of free fatty acids, so we would not suggest Crisco for use on acne-prone skin. Many of the currently popular moisturizers are also comedogenic. We suggest



Fig. 4. Results with Staticin. Note the irritation and follicular keratosis that developed after 2 weeks of Staticin application. The identical results were obtained with laureth-4, an ingredient in Staticin.

petrolatum or mineral oil if a temporary moisturizer is needed by an acne sufferer. Albolene is a moisturizing product which is noncomedogenic.

Among the therapeutic agents, Retin-A Cream and Hytone are interesting examples of formulations that use potent comedogenic vehicles. Both preparations contain isopropyl myristate as one of their major ingredients and both formulations rank high on the comedogenic scale. The high content of isopropyl myristate in the Retin-A Cream may explain the limited usefulness in acne sufferers compared to the Retin-A Gel. The content of isopropyl myristate in the Hytone cream may account for some of the acneiform flare-ups seen in patients with perioral dermatitis following the application of this hydrocortisone cream over prolonged periods. Sulfoxyl is also comedogenic, perhaps from the stearic acid and/or isopropyl



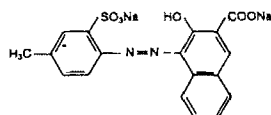
palmitate used as ingredients. Staticin produces both surface irritation and follicular keratosis (Figs. 4 and 5), secondary to the presence of the detergent, laureth-4, in the vehicle. Laureth-4 is also present in Desquam-X and Panoxyl, although its therapeutic benefit in acne has never been demonstrated. Persadox HP Cream contains sodium lauryl sulfate, another potent comedogen. The long-term adverse effects of these ingredients need to be examined. We would certainly recommend that the dermatologists use benzoyl peroxide products that do not contain laureth-4 or sodium lauryl sulfate, as these latter additions have never been documented to improve the therapeutic index of acne products.

Ingredients

Lanolin continues to be a very popular ingredient in cosmetics. It is interesting that the pure anhydrous lanolin and the lanolin alcohol are less offensive than the chemical derivatives of lanolin,

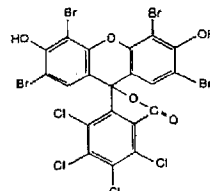
D & C RED NO. 6

Definition: D & C Red No. 6 is a color classed chemically as a monoazo color. It conforms to the formula:



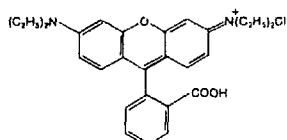
D & C RED NO 27

Definition: D & C Red No. 27 is a color classed chemically as a fluoran color. It conforms to the formula:



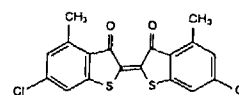
D & C RED NO. 19

Definition: D & C Red No. 19 is a color classed chemically as a xanthene color. It conforms to the formula:



D & C RED NO. 30

Definition: D & C Red No. 30 is a color classed chemically as an indigold color. It conforms to the formula:



CARMINE

Definition: A pigment derived from carminic acid. It conforms to the formula:

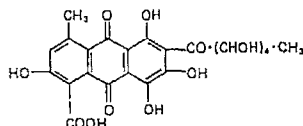


Fig. 6. Carmine and the D & C Red pigments. Examples from the various cases of D & C Red pigments, demonstrating their chemical similarity compared to carmine.

such as acetylated or ethoxylated lanolin. The lanolin is reacted chemically to produce an acetylated or ethoxylated derivative which is not so sticky and is more water-soluble. However, these qualities also appear to make it more of a penetrant into the follicle.

Special attention must be given to the analogs of the isopropyl myristate group, such as isopropyl palmitate, isopropyl isotearate, butyl stearate, isostearyl neopentanoate, myristyl myristate, decyl oleate, octyl stearate, octyl palmitate, or isocetyl stearate. These are common in cosmetics and are added to give cosmetics their slick, sheer feel. However, these esters are derivatives of fatty acids, and the derivatives are more positive in the rabbit ear than the fatty acids themselves. As a group, they should be eliminated from the cosmetics as there are acceptable substitutes. However, beware of the newly advertised substitutes. One of

Table III. Lipids derived from the stearic acid

Ingredient	Comedogenic score
Zinc stearate	0
Glycerol monostearate	1
Stearic acid	1-2
Stearyl alcohol	2-3
Butyl stearate	4
Isopropyl isostearate	5

the new introductions is PPG-2 myristyl propionate. This compound was introduced as a relatively noncomedogenic substitute for isopropyl myristate. However, in our studies, we found the agent equally as comedogenic and even more of an irritant than isopropyl myristate in the rabbit ear (Table I and Figs. 1 and 2).

Our studies indicate that the comedogenicity of a lipid depends not only on its chemical class but

also on its ability to penetrate into the follicle. Take, for example, the family of lipids derived from the stearic acid, as shown in Table III.

When the stearic acid is combined with a metal, such as zinc, or with a sugar such as glycerin, the highly charged zinc or glycerin inhibits the penetration and the comedogenic grade is minimal. The stearic acid is less of an offender than the stearyl alcohol. As the penetration of the stearate increases with such derivatives as the esters, i.e., butyl stearate, so does the comedogenicity. The most offensive is an easily penetrating branch chain stearate, the isopropyl isostearate, producing a potent 5 reaction. Beware of similar chemical modifications of parent lipids such as lanolins, as the more "elegant" derivatives may be better penetrants, i.e., ethoxylated lanolin, and become more comedogenic.

Perhaps our most interesting new finding is the comedogenic potential of the D & C Red pigments (Fig. 6). These colors are added to cosmetic formulations to give them the red tints needed for blushers. We missed these red pigment problems in our early evaluations. Although we were continually plagued by the comedogenic potential of blushers and kept testing the ingredients, it was not until we decided to test the pigments that the problems were uncovered. The D & C Red pigments were comedogenic; the iron oxide pigments and the ultramarine blues were not. We have tested many of the D & C Red colors, hoping to find some that were not comedogenic. The pigment distributors, H. Kohnstamm & Co., New York, NY, provided us with D & C Red colors derived from xanthenes, monoazoanilines, fluorans, or indigoid chemicals. Unfortunately, all are comedogenic.

This may explain why cosmetic acne is frequently most severe on the upper cheekbones where these blushers are applied. Blushers are a particularly severe problem as many cosmetics consumers will use them diligently even though they may use their other cosmetic preparations only occasionally. In reviewing the chemistry of the D & C Red colors, we found that they were originally aniline dyes produced from coal tar. Now they are made synthetically but retain the same potential for skin penetration that is characteristic of the aniline

family of chemicals. This led us to the only possible alternative—eliminate the D & C Red colors from cosmetics. While discussing the problem with chemists at H. Kohnstamm & Co., they suggested a red dye called carminic acid. This dye is sold as a pigment under the name of carmine. This color has quite an interesting history, as it was discovered by Cortez when he found the Aztecs. The red dye is derived from insect wings, and it takes 70,000 insect wings to make one pound of dye. Unfortunately, this natural source also makes it rather expensive, but carmine is noncomedogenic and an acceptable red color for a blusher. Currently, we know of no commercially available blushers which contain carmine; however, carmine is used in pressed eyeshadows when D & C Reds are not. The more complete eyeshadow lines have excellent colors which can be used as blushers. Make sure the powder is pressed with an oil such as mineral oil and not with isopropyl myristate.

Of the remaining ingredients, a special comment should be made about precipitated sulfur. We have tried repeatedly to reproduce Dr. Kligman's results indicating that precipitated sulfur was a potent comedogen. We have been relatively unsuccessful. Of the six sulfur samples obtained from sources around the world, only one was found to be slightly comedogenic. This was the sulfur from Italy. Of course, it is conceivable that certain sulfurs may be comedogenic due to their association with petroleum refining. However, in our hands, U.S.P. grade precipitated sulfur is relatively noncomedogenic. In reviewing Dr. Kligman's results, we discovered that his studies on sulfur were done with sulfur incorporated in the vehicle of hydrophilic petrolatum (U.S.P.). In reviewing the U.S.P. formulation, we found that U.S.P. ointment contains 1% sodium lauryl sulfate. Sodium lauryl sulfate is quite comedogenic in the rabbit ear assay, and his results may, in fact, reflect the sodium lauryl sulfate content of the test vehicle and not the sulfur. Our results would certainly agree with the experience of clinicians who have used sulfur for years without a flare-up of acne or an appearance of closed comedones. We do not use sulfur alone in clinical practice but find it quite useful when combined with benzoyl perox-

ide in potentiating the therapeutic response and would like to state that sulfur has not been a problem in this combination.

Some of our results with other ingredients are not exactly identical to those reported in 1976.⁴ As there are many sources and grades of cosmetic ingredients and also a possibility for individual variation among rabbits, a variation in results is certainly possible. Examples are cetyl alcohol and polyethylene glycol 300. In our original studies, the cetyl alcohol was found to be noncomedogenic, but on repeat, it was comedogenic. The reverse was true of polyethylene glycol 300. It was comedogenic in our first studies, but the present source was noncomedogenic. We can only

recommend that each raw material source and grade be constantly evaluated by the manufacturer to check for variation in cosmetic raw material.

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ABSTRACTS

Measurements of the annual variation of the erythema dose of global radiation

Ambach W, Rehwald W: *Radiat Environ Biophys* **21**: 295-303, 1983

In the fall, the share of skin erythema-producing light rays within the total daily sunshine may be 50% greater than in the springtime. This annual variation, comparing the same solar declinations, appears to be caused by ozone accumulation. Our changing optical air mass, as described by these authors, is an important determinant of diurnal, as well as annual, variations in the light intensity at the surface of the earth where we live.

The aetiology of oligomenorrhoea and/or hirsuties: A study of 467 patients

Ferriman D, Purdie AW: *Postgrad Med J* **59**:17-20, 1983

Of these 467 patients with either or both hirsutism and oligomenorrhoea, 70% had polycystic ovarian disease. A good factor to predict this ovarian disease is hirsutism. About 10% of these cases of oligomenorrhoea were thought to be psychogenic, and these patients tended not to have hirsutism. Anorexia nervosa tends to cause a non-hirsute oligomenorrhoea. This useful study includes details about hirsutism, ovarian size, use of birth control pills, and menstrual history.

Serial determination of serum ferritin levels in patients with malignant melanoma

Lugar TA, Linkesch W, Knobler R, Kokoschka EM: *Oncology* **40**:263-267, 1970

For unstated reasons, the serum ferritin levels of patients with stage III melanoma may be increased. This is a pilot study involving ninety-one patients, thirteen with stages II and III melanoma, but a control group is lacking of comparably ill patients without melanoma.

Cutaneous manifestations in renal transplant recipients

Bencini PL, Montagnino G, De Vecchi A, Tarantino A, Crosti C, Caputo R, Ponticelli C: *Nephron* **34**:79-83, 1983

Almost all (100 of 105 in this report) renal transplant recipients have skin disorders. About three-fourths have some cutaneous infection, often fungal. Adverse reactions to drugs, especially to steroids, are common. Dermatologists will need to watch these patients carefully, remembering that premalignant and malignant disorders of skin are increased in these patients.