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Biological Influence of Gamma Rays on the Glandular and Hair System of the Skin in Normal and Pathological Conditions

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BIOLOGICAL INFLUENCE OF GAMMA RAYS ON THE GLANDULAR AND HAIR SYSTEM OF THE SKIN IN NORMAL AND PATHOLOGICAL CONDITIONS¹

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THE biological influence exerted by radio-active rays on the skin and its glandular and hair system could be thoroughly studied on account of the easy direct observation of this tissue during all the phases of its reactive period.

The skin, considered as an organ in itself, does not passively endure any stimulation applied on any part of its surface, but presents various local and general reactions. Consequently, when we irradiate some part of our body through the skin, we must consider separately the biological reactive symptomatology of the skin in the irradiated zone, in the other parts of that skin region, and in other organs.

The study of distant reactions is peculiarly interesting whenever we regard the skin as the only way by which the influence of rays is transmitted, or when we take into consideration another factor, that is, the endocrine sympathetic system.

Let us consider now the way in which the different structures annexed to the skin react to the influence of radio-active rays.

First of all, let us observe the reaction of the hair system in normal and pathologic conditions, without obviously losing sight of the sebaceous and sudoriferous glands of the skin.

Since we are going to speak about the influence that rays exert on the skin, we shall first briefly mention the classic skin erythema which was considered in the past as a biological sign determining the efficiency of different doses of rays. As I have already had the opportunity of stating many times, the skin erythema is not an absolute biological test; in fact, this sign is not a constant one, as it depends upon different local and general conditions.

On the contrary, when we employ radium, applying it on a hairy region, as for instance the scalp, a dose of gamma rays from different crossed fields and by means of a molded apparatus according to the technic already described by me (since 1919), we always observe a constant biological reaction; that is, the complete falling out of hair at the end of a three-week period after irradiation, though we do not observe any estimable clinical alteration of the skin.

The growth of new hair, preceded by a *poussée* of thin down one month after the falling out of the hair, is a fact as sure as the defluvium itself; this statement is supported by the observation of nearly one thousand cases.

An important fact that we state in connection with our study of the biological reaction is that the quantity of new hair is greater than that of the fallen hair; the new is stronger, and its color is darker. (See Figs. 1, 2, and 3.)

In cases in which irradiation had to be repeated, as, for instance, in successive scab contagions, this reactive symptomatology was still more accentuated. Under the influence of radio-active radiations applied at an epilation dose, the hair root shows a sort of exalted reproductive functionality. The epilation dose has a siderating influence on the mother-cells of the hair papilla, with subsequent hair fall; the growth of new hair depends upon a local reaction of different, although always accentuated, intensity. This difference of intensity depends upon all the local and general factors determining every single mode of reaction (see Fig. 4).

If we insist in irradiating successively during a certain period of time, we see that the hair papilla begins to react in a different way. The germinating elements

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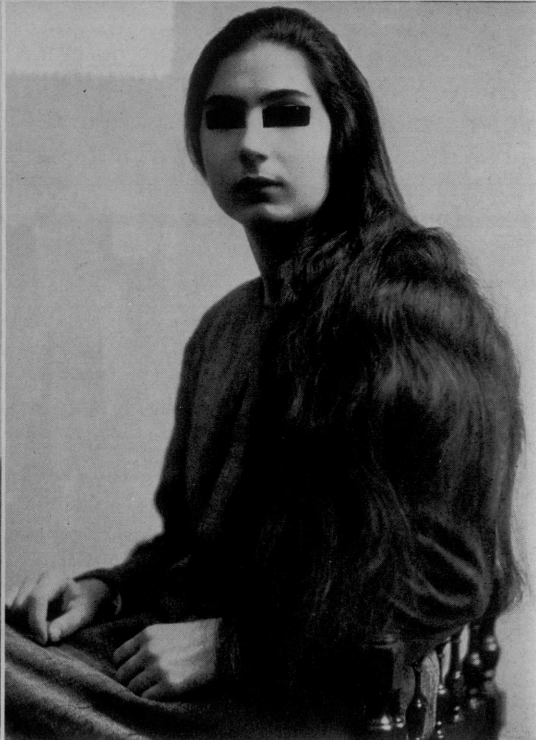
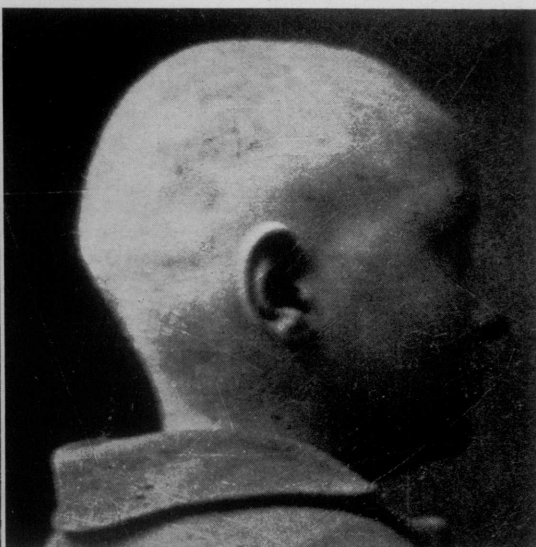
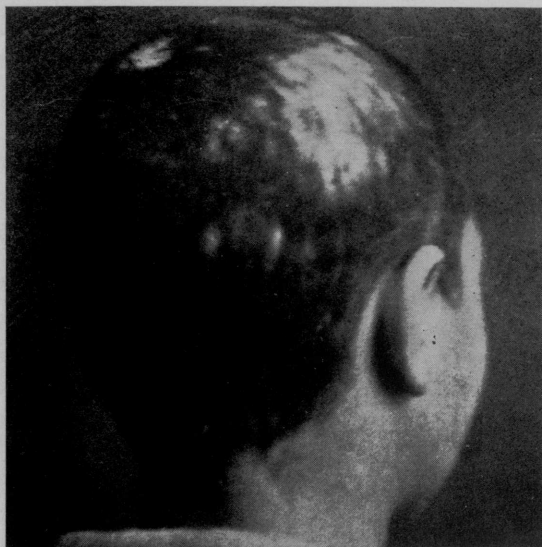


Fig. 1 (*upper left*).
Fig. 3 (*lower left*).

Fig. 2 (*upper right*).
Fig. 4 (*lower right*).

react with an accentuation of the vital phenomena and the climax of radiosensibility corresponds to the period of the hair growth; consequently, if we intervene during this period, the absorption of rays will be greater, and their cytolytic influence stronger. Successive

siderations intensify the local dystrophic manifestations, inducing gradually weaker reactions on the side of the cells, till at last they lose their reproductive power, so that the hair does not grow any more.

On this theoretical base we have founded the practical realization of our technic

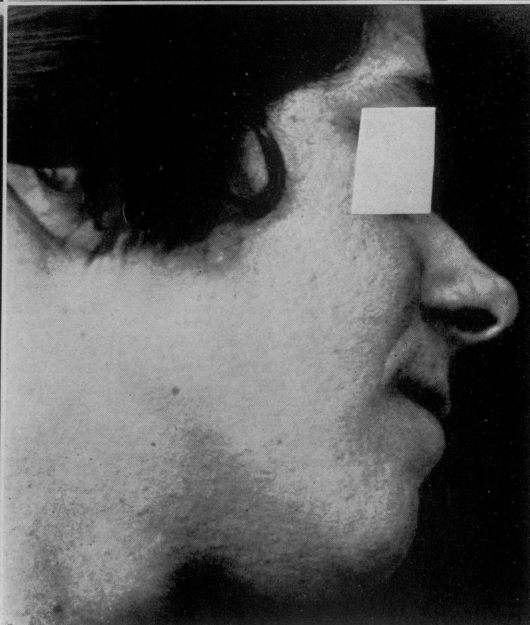
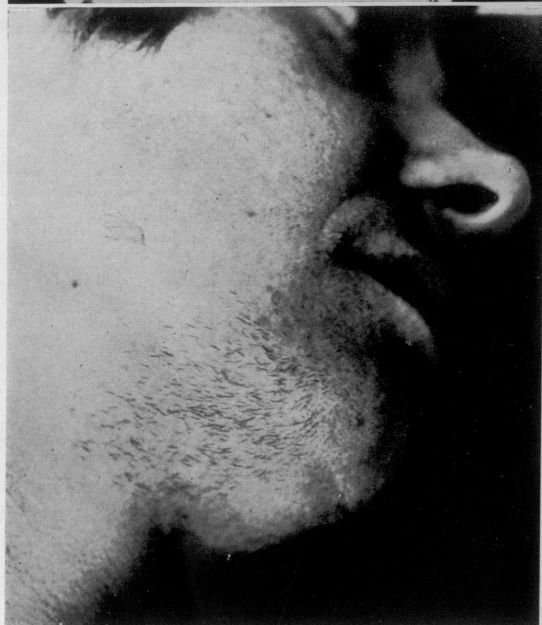
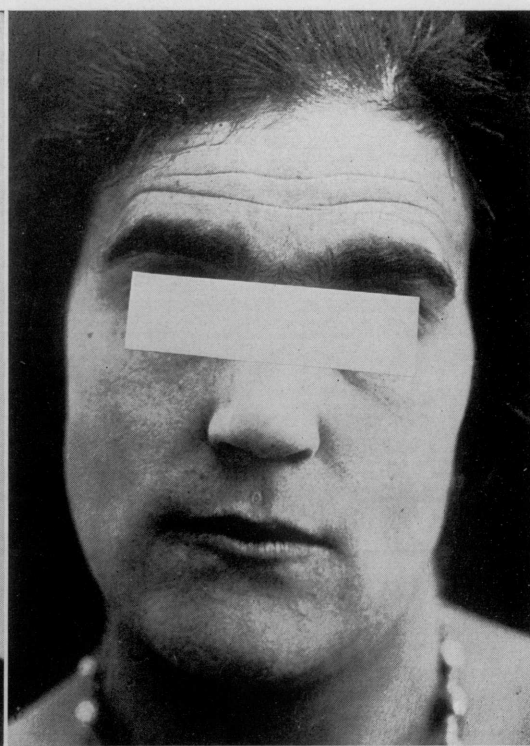
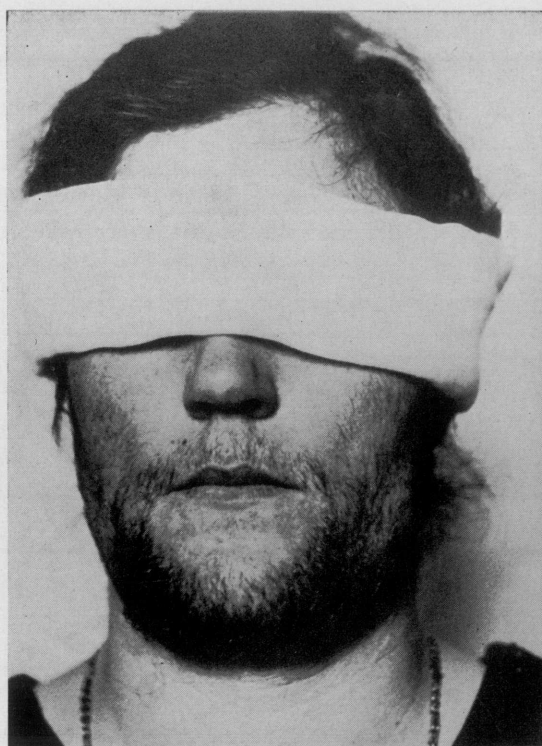


Fig. 5 (*upper left*).
Fig. 7 (*lower left*).

Fig. 6 (*upper right*).
Fig. 8 (*lower right*).

of "cosmetical radium epilation in cases of feminine hypertrichosis."

The hair defluvium always occurs without any clinically appreciable reaction on

the side of the skin. The long experience we have in this field allows us to state that this method does not produce any such skin alteration as might possibly

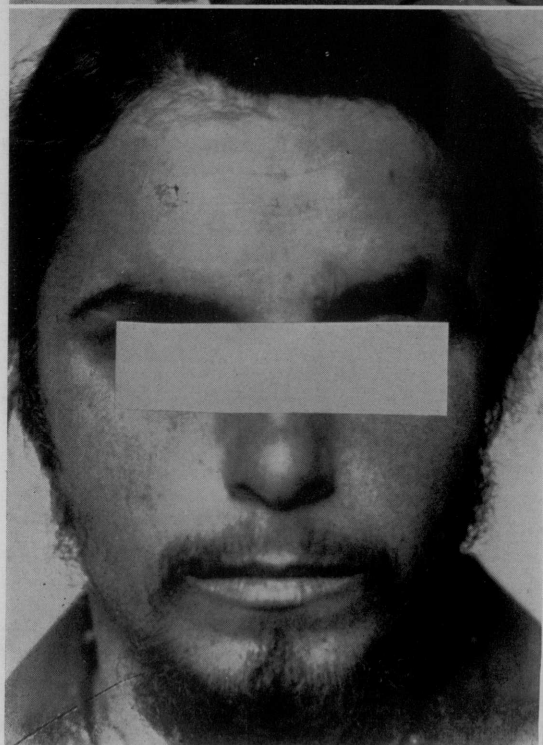
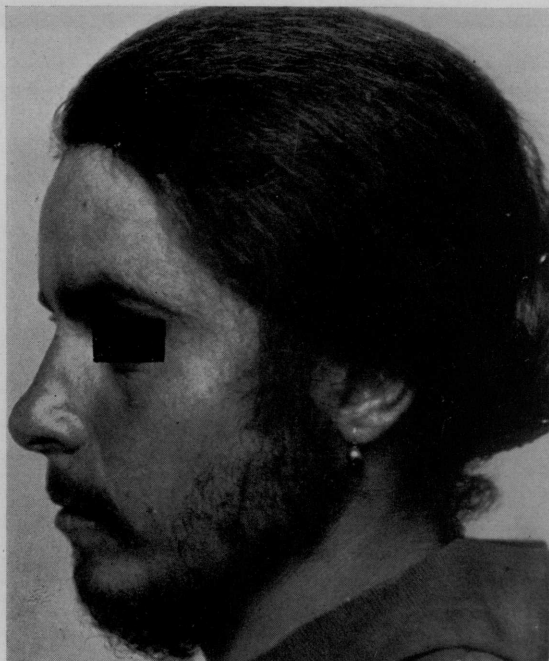


Fig. 9 (*upper left*).
Fig. 11 (*lower left*).

Fig. 10 (*upper right*).
Fig. 12 (*lower right*).

occur, even after a long period of time, in consequence of Curie therapy applied with a different therapeutic scope. In such

cases the skin appears atrophic, dyschromic, with telangiectases and zones of radio-epidermatitis and radiodermatitis, as

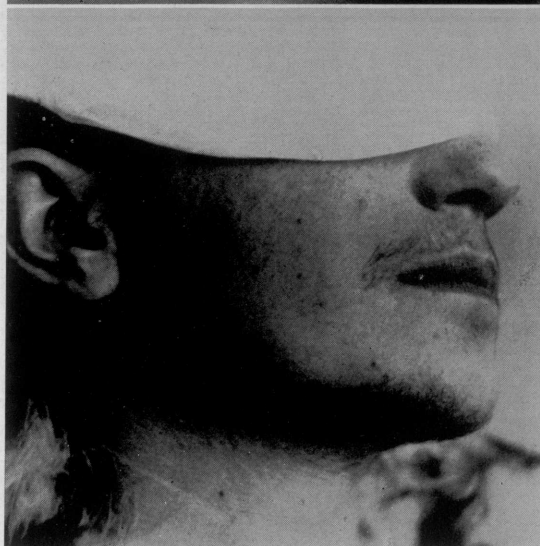


Fig. 13 (*upper left*).
Fig. 15 (*lower left*).

Fig. 14 (*upper right*).
Fig. 16 (*lower right*).

a consequence of an altered nutrition caused by the intensive irradiations it has undergone (Figs. 5-16).

Rays pass uniformly through the skin, but their biological influence (that is to say, the absorption and the reaction of different parts of the skin) does not correspond to their physical homogeneity (quantity, quality of the irradiation, and penetrating power). One given kind of irradiation may have merely an inhibitory influence on the physiologic function of

some structures, as for instance, the glandular tissue, whereas it is absolutely negative for connective tissue.

The increased secretory activity of sebaceous and sudoriferous glands (steatosis and hyperhidrosis) may be relieved by even a single irradiation which does not directly influence the glands, but controls the activity of the neurovegetative system upon which depends the glandular function.

Thus, in cases of acne vulgaris of the

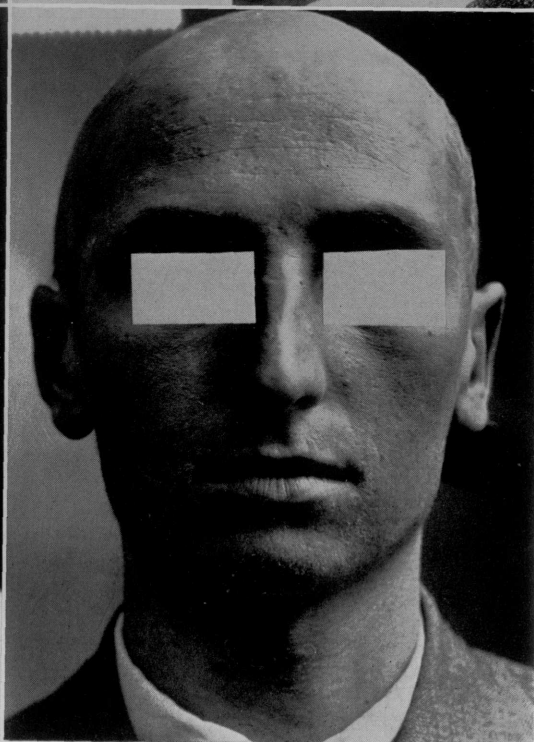
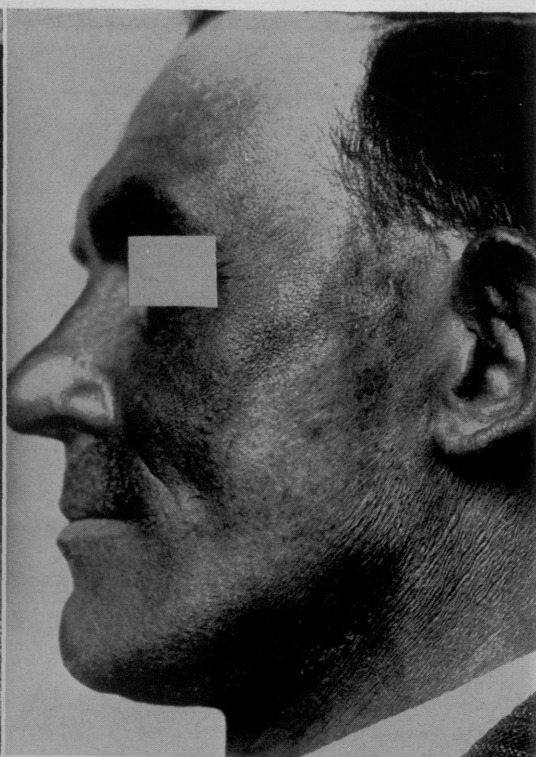


Fig. 17 (*upper left*).

Fig. 19 (*lower left*).

Fig. 18 (*upper right*).

Fig. 20 (*lower right*).

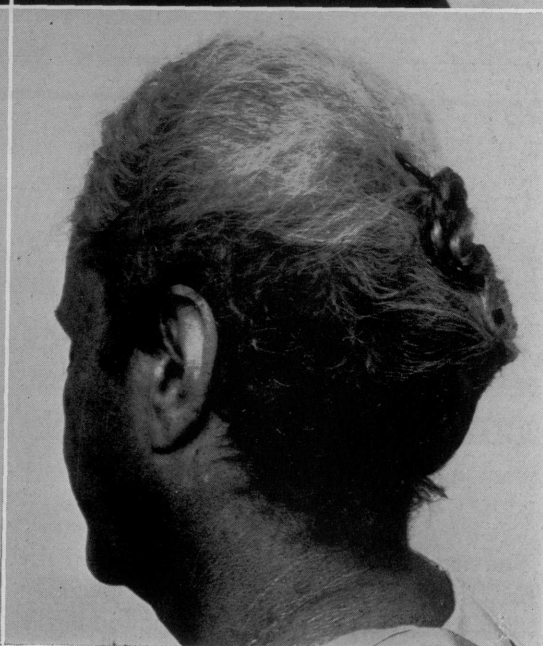


Fig. 21 (*upper left*).
Fig. 23 (*lower left*).

Fig. 22 (*upper right*).
Fig. 24 (*lower right*).

face, gamma rays do influence the glandular secretory elements, which are more radiosensitive than the other structures of the skin; even a single irradiation may

bring about a complete recovery in those cases. Obviously this local therapy is applied after a general medical treatment of the patient (Figs. 17-20).

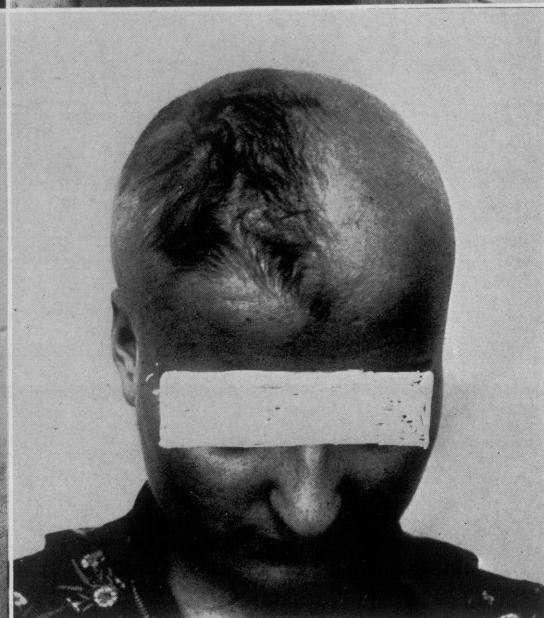


Fig. 25 (*upper left*).
Fig. 27 (*lower left*).

Fig. 26 (*upper right*).
Fig. 28 (*lower right*).

The same effects may be obtained in cases of local hyperhidrosis, especially if it be limited to the face, and particularly to the nose; gamma irradiation applied by means of molded apparatus gives us the possibility of obtaining in this region, too, an homogeneous subdivision of the dose in all the cutaneous and subcutaneous tissues.

We have had the opportunity of observing some regions of the scalp which

had incidentally undergone epilation as a consequence of irradiation applied to neighboring regions. We thus had the possibility to state a fact which is very important from a radiobiological point of view: white hair falls and is replaced by darker, thicker and often curly hair even in subjects more than 70 years of age. (See Figs. 21-25.) This growth of dark hair, replacing the fallen white hair after a gamma irradiation applied at the epila-

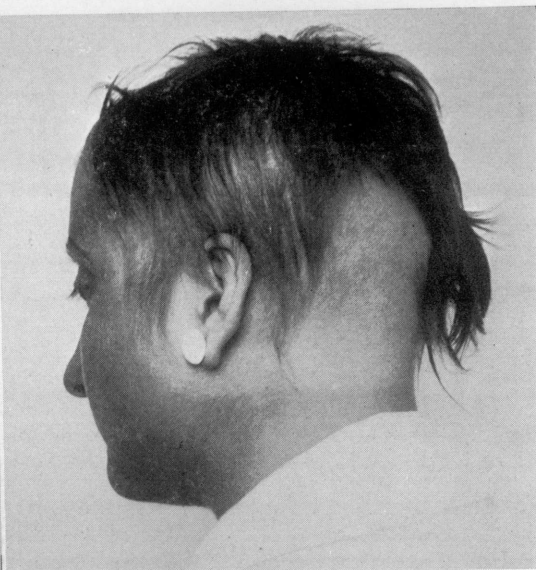


Fig. 29 (*upper left*).
Fig. 31 (*lower left*).

Fig. 30 (*upper right*).
Fig. 32 (*lower right*).

tion dose, may be interpreted only as a rejuvenating process taking place in the hair system. In fact, the loss of pigment is generally a symptom of hair senescence.

The study of such cases observed during many years, with special reference to the general reactive organic powers and to the endocrino-sympathetic function, convinced me of the usefulness of employing this type of irradiation in the treatment of alopecia.

In fact, the first case I treated in such a

way four years ago could not possibly present a better result than the one we obtained. It was a form of total alopecia of the scalp and of the eyebrows in a female subject, 21 years of age. The disease had already lasted three years and had resisted every type of local and general treatment (arsenical and phosphoric pluriglandular opotherapy, ultra-violet rays). (See Figs. 26 and 27.) We irradiated first one-half of the scalp and ob-



Fig. 33 (*upper left*).
Fig. 35 (*lower left*).

Fig. 34 (*upper right*).
Fig. 36 (*lower right*).

served a partial growth of hair, limited to the irradiated region; on the same side we observed the growth of some hairs of the eyebrow (Fig. 28). The second irradiation was applied to the left half of the scalp, but not on the whole surface of this region. Hair grew only in the irradiated zone; the part that had not been irradiated was still hairless. After this irradiation the left eyebrow was also restored. Menstrual disorders (dysmenorrhea) were controlled. (Figures 29 and

30; Figures 31 and 32 show condition after the second irradiation of the scalp.) The way in which this case reacted to the radio-active irradiations applied by us is worth some biological consideration.

First of all, it appears that gamma rays have a direct local therapeutic influence: the hair grew only in the irradiated regions. This influence may extend to more distant zones of the same side of the body, as we may see by observing the growth of the eyebrow. The irradiation has also un-

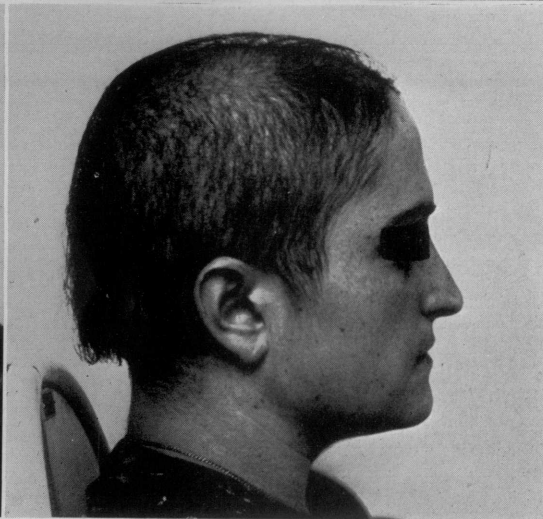


Fig. 37 (*upper left*).
Fig. 39 (*lower left*).

Fig. 38 (*upper right*).
Fig. 40 (*lower right*).

doubtedly an influence on the general conditions of the patient, as evidenced by the return of menstruations. In the first case a determining factor was represented also by secondary radiations of the skin, whereas in the second case this determining factor is to be found in an influence exerted through the endocrino-sympathetic system.

We applied this technic in different

subjects of both sexes, who suffered from total or partial alopecia. In nearly all our cases we observed a new growth of hair which was more or less complete, with only few exceptions. In some cases we assisted to a new falling out of hair after a violent psychical trauma. One must not lose the hope of obtaining a new growth of hair after a second intervention, which must be made when the functions of the

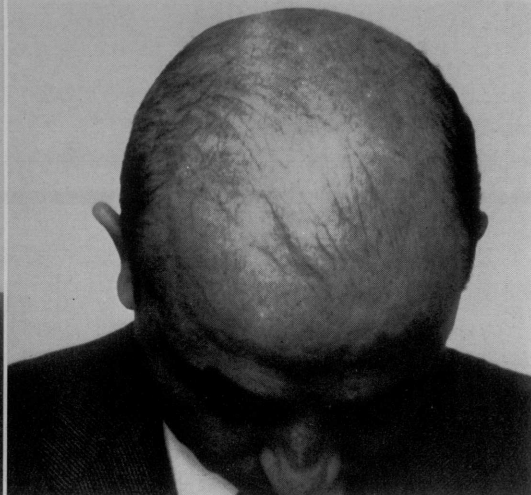
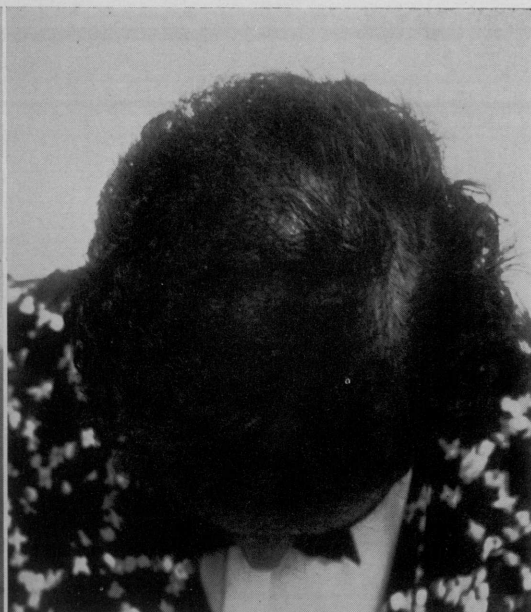


Fig. 41 (*upper left*).
Fig. 43 (*lower left*).

Fig. 42 (*upper right*).
Fig. 44 (*lower right*).

neurovegetative system shall have acquired its full balance. (See Figs. 33-42, inclusive.)

After all the experiences we had in this field, we came to the idea of treating premature baldness, which grieves men perhaps still more than facial hypertrichosis does women.

Our first results in this field were very favorable; after a period of defluvium which takes place particularly in cases accompanied by seborrhea, the hair grows

in greater quantity than before, and white hair is substituted by dark wavy or even curly hair. Our colleagues, who were affected by baldness, were numbered among our first subjects; they were well satisfied with the results we obtained and are to-day the most convinced advocates of this therapeutic method, which they recommend as an absolutely harmless and very efficient one (Figs. 43, 44, 45, and 46).

Thus a new way is open in this field to



Fig. 45



Fig. 46

radiobiological study as well as to gamma-ray therapy. As we employ a special cap, gamma rays may be uniformly applied on the surface as well as in depth, notwithstanding the irregularity of the irradiated surface.

Facial hypertrichosis of women, alopecia, and premature baldness are all real illnesses which may have an influence on social life and compromise nervous func-

tions, possibly leading to a real form of phobia. The gamma therapy may bring about noticeable and sometimes even un hoped-for results. This method must be recommended in the interest of such patients, because only by its beneficial influence may they be restored again in such conditions as to perform serenely their duty toward family, society, and toward country.



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