with a brain-storm not merely because her period is imminent nor yet because the cook gave notice, but because the cook happened to take offence on the twenty-seventh day of her mistress's menstrual cycle. That blushing youth of 28 who finds increasing difficulty in concentration and who is progressively shunning social life will not be cured if you merely show by his increased basal metabolic rate that he is suffering from hyperthyroidism; nor is his condition solely due to the conflict over early masturbation (which the least competent psychotherapist can detect); nor would you be correct in attributing his whole syndrome to the horizontally impacted third molars revealed by radiography. His adjustment to life can only be rectified when the dental surgeon, the metabolist, and the psychotherapist co-operate. And that woman who has been a self-pitying, spineless neurotic ever since you knew her, defeats your patient, if pessimistic, therapy, not merely because her husband drinks, but because she has suffered from diverticulosis longer than you have known her. You may prescribe a change of husband, but unless you can give her a new heart and a new colon, do not expect a radical cure.

The Future Psychotherapist

If, as psychotherapists, we are to deal with those who are out of tune with themselves and with life, we must be prepared to recognize, if not to treat, every morbid factor from narcissism to hookworm. And this brings me to a point of mere historical interest. Psychotherapy is going the way of all recognized specialties. The future psychotherapist must specialize early if he is ever to succeed. That there is something wrong with our medical and social conceptions here, I am convinced. But the fact remains. It is impossible to hold up the tide, and we need no longer expect to see the ranks being recruited from general practice. I confess to a certain misgiving when I contemplate these young graduates of both sexes who embark on psychotherapy with a medical degree, perhaps a D.P.M., and their own personal analysis. Technically they are often very well equipped, but they have never tackled a difficult labour single-handed, they have never been in the death-stricken home, they have never witnessed the father's irritability nor the mother's indulgence—in short, they have never made contact with the emotional microcosm in which patients live. But the men and women who have served their apprenticeship in general practice (and I am glad to say we have a few bow-and-arrow members of the Institute staff) have learned things that are not written in books, things that don't occur in institutions, that have no relation to cerebral localization, and on which the physician's own analysis throws no light. Peradventure, in some remote future, the ideal psychotherapeutic clinic will be made possible by ideal medical organization. This would include, I sincerely hope, a system whereby the psychotherapist had a certain degree of maturity and experience to combine with his special theories and technique.

The fact of the matter is that the youthful psychotherapist is deficient in the practical philosophy of life. He may know a great deal about compensation and introjection, but if he has not acquired a certain capacity of valuation he can be no more than a doctrinaire in the guidance he offers to his patients. Indeed, I would venture to say that the weakness of psychotherapy to-day lies most of all in its failure to comprise on the one side biological factors, and, on the other, philosophical considerations. All attempts to restrict the field of maladjustment to a purely psychological aetiology must end in discrediting it in the eyes of those who maintain that to see life aright we must see it whole.

OBSERVATIONS ON THE ABSORPTION OF CAROTENE AND VITAMIN A

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The problems of fat absorption concern not only the true fats (glycerides) but a wide variety of substances, many of them of outstanding biological importance, which are found in close association with the fatty components of foods. For many years those engaged in the study of the mechanism of fat absorption in the body gave attention solely to the glycerides, and ignored the no less important question how such "unsaponifiable" substances as cholesterol enter the tissues. In recent years, however, it has become more urgent that this aspect of "fat metabolism" should be studied, because of the rapid strides made in our knowledge of the nature and function of the "fat-soluble vitamins" and related compounds.

It is now established that a wide variety of chemical substances, sharing with the true fats but the one property of showing similar solubilities in certain solvents, are absorbed from the intestine with an ease and to an extent that was unsuspected. Perhaps the most striking example is that recorded by Professor Channon, in which the hydrocarbons of ordinary medicinal "liquid paraffin" were found to be absorbed from the intestinal tract of rats and pigs and stored to a surprising extent in the liver.¹

In discussing the absorption of such substances, or for that matter that of the true fats, two main lines are indicated by existing knowledge. In the first place it is clear that there are at the present time good reasons for seriously entertaining the view that particular absorption may occur.² Alternatively, a more conventional path may be followed by trying to picture an intermediate conversion of these "fat-soluble" substances into "water-soluble" and "diffusible" forms. In thinking of the formation of "water-soluble" complexes the possible function of the bile comes immediately to mind, and it will be remembered that more than one theory involving the agency of that secretion has been advanced. The work of Moore and Parker³ and later certain observations by Channon and Collinson¹ brought forward the question whether mere solubility in bile might be the chief factor determining absorption of certain fatty substances. As the latter observers point out, however, this explanation fails to account satisfactorily for the passage of the constituents of "liquid paraffin" through the intestinal wall. Another aspect of the possible part played by the bile concerns the belief that the bile acids may form water-soluble complexes with a variety of fatty substances. At the moment this theory is attracting a good deal of attention, mainly as a result of the work in the laboratories of Fürth,⁴ Verzár,⁵ and Schmidt.⁶

Of particular interest to us in this connexion are the complexes which it is stated can be formed between desoxycholic acid and carotene and desoxycholic acid and vitamin A, two "fat-soluble" substances of outstanding importance in human and animal nutrition. The former has been described by Euler and Klüssmann⁷ and by Greaves and Schmidt,⁶ and the latter by Shimizu and Hatakayama.⁸ These interesting materials appear to be water-soluble, and might, therefore, reasonably provide a form in which fat-soluble unsaponifiable substances could be transported through the intestinal wall.

Examination of Chylous Fluid from the Human Subject

It is rare to find an opportunity to study fat absorption by direct examination of the character and composition of the contents of the thoracic duct in man, but such was provided by the interesting case of chylothorax which came under the notice of one of us (M. E. B.) and which is described in the accompanying paper (p. 1211). The character of the lesion in this patient was such that a not inconsiderable proportion of the chyle was diverted and collected in the pleural cavities. As it was necessary to remove this fluid every few days in order to afford some relief to the patient an attempt was made to ascertain to what extent, and in what form, the carotene and vitamin A administered by the mouth in the course of treatment appeared subsequently in the chyle. The data obtained in the course of this investigation are set out in the following table.

Date	Material Administered	Chylous Fluid Removed	Analysis of Fluid	
			Carotene	Vitamin A
		c.cm.	mg. %	mg. %
4/9/34	100 mg. carotene between September 4th and 11th	1,140	0.034	0.10
11/9/34		3,040	0.045	—
17/9/34		1,560	0.050	—
19/9/34	Vitamin A dosage begun September 19th— Avoleum capsules 6 daily. By September 28th total intake 0.125 mg. vitamin A	1,080	0.087	0.13
23/9/34		1,080	0.065	0.23
28/9/34		1,320	0.058	0.61
30/9/34		900	0.051	0.34
2/10/34	—	1,800 from abdomen	—	—
4/10/34	—	1,140	—	0.18
8/10/34	—	1,200	—	—
13/10/34	—	1,230	—	—
15/10/34	—	2,700 from abdomen	—	—
17/10/34	—	930	—	—
24/10/34	—	600	—	—
27/10/34	—	2,040 from abdomen	0.034	0.15
29/10/34	—	1,020	—	—
1/11/34	About 150 mg. carotene given between October 30th and November 4th	1,200	—	—
4/11/34		1,080	0.034	0.20

At post-mortem about 1,200 c.cm. removed from thorax.

Estimations of carotene and vitamin A were made on material extracted by ether from samples of the chylous fluid after treatment with sodium hydroxide and alcohol, which facilitated dispersal of the colloidal system. The carotene was estimated colorimetrically, using a Hellige colorimeter and a potassium dichromate standard; vitamin A was estimated spectroscopically.

Excess of Carotene Ingested over Amount Absorbed

The results of the first administration of carotene (100 mg. between September 4th and 11th) are reasonably clear. The analysis of the chylous fluid before the administration shows that carotene was already present; presumably this originated from the ordinary diet of the patient, which contained a small amount of green vegetables and other sources of the lipochrome. In considering the results of the later analyses it is important to note that there is no reason to suspect that the basal diet was to any significant extent responsible for the variations in carotene content of the pleural fluid.

The figures in the table and Curve A in the chart show that a sharp rise in the carotene content of the chylous fluid followed the intake of carotene. The rise is followed by a steady fall to the level of concentration observed at

the outset of the study. It is not a simple matter to attempt an estimate of the total amount of carotene which appeared in the fluid tapped from the thoracic cavity. But even if we take the maximum value for each period the figure derived (say 2 mg.) falls far short of the amount (100 mg.) which was actually administered. Even if we assume a total daily production of 3,000 c.cm. of chyle—and it must be borne in mind that this is probably an overestimate in view of the poor physique and debility of the patient—the amount of carotene accounted for is not 20 per cent. of that ingested.

The second attempt to study the absorption of carotene failed. Between October 30th and November 4th 150 mg. were administered, but the patient was rapidly declining, and shortly afterwards died. No evidence of an increased carotene content of the chylous fluid was noted, doubtless because absorption was impaired by the failing vitality of the patient.

Vitamin A: Ingestion and Approximate Absorption

The administration of vitamin A was begun on September 19th. Two tablets of B.D.H. avoleum were given three times daily until the 25th. In all fifty tablets were given, and it may be accepted that approximately 125 mg. of vitamin were contained therein.* The total amount of vitamin A present in the fluid removed from the chest

between September 19th, the date at which administration began, and October 4th was approximately 10 mg. The absorption over the period of investigation is shown by Curve B in the chart. Again, assuming in this patient a daily production of lymph of the order of 3,000 c.cm., a rough calculation of the total amount gives us the figure of about 100 mg., which is in reasonably good agreement with the amount actually administered—namely, 125 mg.

The conclusion seems justified, therefore, that the absorption of vitamin A from the intestine was in this case much more satisfactory than that of its precursor carotene. There is nothing remarkable in these results. They merely demonstrate the direct absorption of carotene and vitamin A by way of the thoracic duct, and the type of absorption curves (see chart) are exactly what would be expected.

It is, of course, reasonable to conclude that the rise in vitamin A represents absorption from the intestine and not to some extent formation from the carotene given in the earlier period. The accepted view is that the vitamin is formed in the liver following abstraction of the lipo-

* We are indebted to Dr. W. F. Underhill of British Drug Houses Ltd. for this estimate.

chrome from the circulation by the Kupffer cells.^{9 10 11} There is no evidence that conversion may occur in the body fluids.

"Diffusibility" of the Carotene and Vitamin A

The material in our possession was also examined in order to see whether information could be obtained regarding the physical or chemical state of the vitamin or carotene present. Naturally we did not expect to find bile-salt complexes, because even assuming for them a function of absorption one would expect it to concern solely the phase of transport through the wall of the gut. Actually it was found that direct extraction with ether removed but a small fraction of the carotene and little or none of the vitamin. As regards the former substance this behaviour recalled that of the interesting colloidal suspension of carotene which can readily be prepared (Fodor and Schönfeld,¹² Drummond and Macwalter¹³). The similarity was extended when it was found that a proportion of alcohol would make the pigment readily extractable by ether. As van der Bergh and Müller¹⁴ have pointed out, this behaviour of aqueous suspensions of carotene renders unnecessary the hypothesis advanced by Palmer¹⁵ that carotinoids are carried in aqueous solution in body fluids—for example, the blood—in the form of complexes with proteins.

Experiments with chylous fluid showed that no trace of lipochrome pigment passed through collodion membrane when subjected to ultra-filtration at pH 6.5 to 8 or when dialysed at various reactions over the range pH 3 to 8. It is clear, therefore, that if the carotene was present in a "water-soluble" form it was one incapable of passing an ordinary membrane. A less extensive series of tests was made on the vitamin A, but all the results agreed in showing that it was not present in a "diffusible" form.

A valuable contribution to the study of the problem of the passage through vital membranes of substances "non-diffusible" in the ordinary sense has recently been made by Süllmann and Verzár.¹⁶ They found that artificial membranes of such a porosity that the passage of certain dyestuffs (for example, Congo-red) was permitted, would also allow the diffusion of quite a significant proportion of blood fat. Such artificial membranes are regarded as possessing a permeability comparable in some respects with that of the capillary walls. To accept this view is to dispel many of the difficulties which have faced those who sought to elucidate the process by which the fats pass to and from the circulating fluids.*

But this theory does not satisfactorily cover such other "fat-soluble" substances as those we are now considering. There are very good grounds for believing that transport of the true fats and that of the associated pigments and vitamins may be independent of each other. Presumably, therefore, one cannot assume that systems which under certain conditions may let fats through a structural barrier will necessarily allow associated substances to pass. It is interesting in this connexion that Polleri¹⁷ has recorded the absence of carotene when a pleural exudate from a case showing marked carotinaemia was examined.

Esterification of Vitamin during Absorption

From the properties of material isolated from the fat of the chylous fluid it appeared that the vitamin was present in an esterified condition. As the product administered to the patient contained the vitamin as the free alcohol

it is apparent that esterification had taken place during absorption. This recalls the observation that cholesterol is esterified during passage through the intestinal wall. (This subject is discussed in the recent paper by Fröhlicher and Süllmann.¹⁸) It is not unlikely, therefore, that the facilities of absorption, which the possibility of esterification of the alcohol grouping of vitamin A permits, accounts for the relatively much larger proportion of this substance than of carotene which appeared in the lymph after oral administration.

There is, of course, considerable evidence to show that carotene is more satisfactorily absorbed from the intestine when given in natural foods or in solution in oily foods than when administered in highly concentrated forms.

Summary

1. A study has been made of the absorption of vitamin A and carotene administered to a patient suffering from a condition which led to part of the contents of the thoracic duct being diverted into the pleural cavities. Analysis of the fluid removed at intervals from the chest cavities enabled approximate estimations to be made of the amount of vitamin A and carotene absorbed by way of the chyle.

2. It was found that a relatively small proportion of the carotene administered orally could be accounted for by the pigment found in the chylous fluid, whereas in the case of vitamin A the amount recovered was such as to indicate an almost complete absorption.

3. The vitamin administered as the free alcohol was found present in the lymph mainly in the esterified condition, and it is thought probable that the linkage with the fatty acids during passage through the intestinal walls accounts for the much higher coefficient of absorption as compared with that found when carotene was given.

4. Observations on the chylous fluid show that over a range of reaction much wider than that encountered in body fluids no trace either of carotene or of vitamin A passed a dialysing membrane. Both compounds appeared to be present in colloidal form and closely associated with the highly dispersed fat.

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K. U. Toverud (*Norsk Mag. f. Laegevid.*, March, 1935, p. 259) carried out twenty-five investigations of the metabolism of fifteen women from the twenty-fifth to the thirty-ninth week of pregnancy, and found that thirteen had a retention of iron below that required by the foetus. All the cases with an iron intake below 13 mg. per day showed a negative iron balance. Even with a daily intake of 15 mg. a negative balance occurred in two instances. The frequency of a negative iron balance during the last three months of pregnancy must therefore be taken into consideration in regulating the diet of the pregnant mother, so that it should contain about 20 mg. iron per day in an easily absorbable form.

* Since writing this paper our attention has been drawn to a paper by Mann and Peters (*Journ. Clin. Invest.*, 1933, xii, 1031). These workers present evidence, from standing experiments aimed to produce physiological transudation of fluid from the blood stream, that the capillary walls are ordinarily impermeable both to fatty acids and to cholesterol and phosphatides.