The smallest amount of blood from which the Commission succeeded in isolating the micrococcus is, according to its account, $\frac{1}{250}$th of a cubic centimetre, or approximately four cubic millimetres of blood. I do not, however, agree that this excludes the possibility that the disease can be conveyed to a mosquito in a smaller quantity of blood. On the contrary, it seems obvious that the mosquito has only sucked up enough blood to convey one micrococcus to its stomach in order to transmit the disease and I would suggest that the scarcity of micrococci in the blood of patients (which is not after all very great) explains why the disease is not contracted by everyone who comes to Malta, as patients are nearly always bitten by hosts of mosquitoes. It is to be noticed that later in the report this escape of the many is mentioned as an argument against the mosquito theory of transmission but, as I have shown, it is really just as strong an argument in its favour. I think also that a mosquito may on occasion suck up more than four cubic millimetres, while, lastly, it is obvious that if a hundred mosquitoes bite a patient suffering from Mediterranean fever, which surely often happens, the total amount of blood abstracted by them is likely to be much more than the four cubic millimetres and may possibly amount to several hundreds of cubic millimetres, so that in this case not one but many of the insects may become infected.

I now come to Part II. of the report. On p. 48 we read: "Milk is not so closely connected with water in Malta as it is in most other countries, because the great majority of people get their milk-supply in their own vessels direct from the goat." I do not understand why vessels should not become contaminated by the water in the homes of the populace as much as vessels do in the dairies of other countries. Experience of the lower orders in Malta goes to show that they are not much more cleanly in their habits than the average goat and we read in the report of the Commission that in one house the occupants used the same bucket for washing the vegetables as they employed for carrying their excreta to the midden.

In Part III., at p. 37, we read that monkey No. 43 was repeatedly given hypodermic injections of broth growth from the breaths of Malta fever patients. The injections were frequently given from Oct. 27th to Dec. 4th. The blood of the animal was repeatedly tested for agglutination reaction with micrococcus Melitensis during the period of the experiment. I make the following extracts:—

On 7th of November doubtful tendency to agglutination, $\frac{1}{10}$, $\frac{1}{20}$; on 12th somewhat ailing; on 28th slight agglutination reaction, $\frac{1}{10}$, $\frac{1}{20}$; on 5th of December tendency to agglutination in $\frac{1}{10}$ dilution; on 12th no agglutination reaction; on 15th dying, gave chloroform. P.M. Pneumonia and pericarditis. Inoculated slopes from all organs.

23rd December no M.M. recovered p.m., but a glucose fermenting + Gram staining coccus was obtained from spleen, liver, and kidneys, nothing from heart's blood and lungs.

In the remarks upon this experiment we read: "There is to be noticed in both these animal experiments the development of a low agglutination reaction and here, as in the skin experiments, I should attribute this to the ingestion of M. Melitensis toxins, as a certain amount of saliva trickled down the long entry tube and so into the broth." I would here point out, whilst admitting the *possibility* of the above conclusion being the right one, that it has been shown that agglutinins are not entirely specific in their action—i.e., that, in some cases at any rate, treatment with a particular organism may increase the agglutinating power as affecting other varieties of germs (Bosanquet).

In the above experiments the broth injected was shown to contain germs other than the micrococcus Melitensis and the effect of injecting them was seen to be so marked at the post-mortem examination of monkey No. 43 that it is hardly surprising to read that in the serum of the animal the agglutinating power was increased sufficiently to act with a dilution of 1 in 20 upon the micrococcus Melitensis.

I might add, in conclusion, that Surgeon Ross and I have frequently suggested to members of the Commission that the true agent of infection is very probably the mosquito acartomyia Zammitii. Our experiments, observations, and arguments which lead to this conjecture are given in our papers in the *British Medical Journal* of April 1st, 1905, and the *Journal of the Royal Army Medical Corps* for August and September, 1905. It seems a pity that experiments have not been thoroughly undertaken to prove whether or not acartomyia Zammitii is the real agent of infection.

THE WINES OF THE GIRONDE
WITH
SPECIAL REFERENCE TO CLARET.

THE statement which appeared in an annotation in THE LANCET[1] a little over a year ago that "Bordeaux wines or clarets were never cheaper, more abundant, and purer than they are in the present day" proves to be well founded in view of the results of a practical inquiry which we have recently undertaken. It is somewhat remarkable, therefore, that the belief still gains currency that the bulk of the claret sold at the present time in this country is too cheap to be good and that the genuine produce of the Médoc can only be obtained at relatively high prices. In giving an immediate answer and denial to this we may as well state at once that we have purchased wines in the open market, in London at all events, at wine merchants, stores, and grocers' shops at prices varying from 1*s.* to 3*s.* a bottle which have proved to be not only genuine but wines of excellent quality also. It is, indeed, highly probable that as a matter of fact the best value in regard to wines at the present time is to be obtained in clarets.

As we shall presently point out, the public, speaking generally, either has uncertain views about claret or, and this is worse, regards it as being deficient in that stimulating power which is only too freely found in strong fortified wines or spirits. The view is unfortunately too commonly held that the most trustworthy form of stimulant is whisky or some other spirit and that these contain alcohol in a pure and harmless form; therefore it is thought that in the choice of a stimulant it is safer to avoid a light wine the origin and genuineness of which are open to doubt. It is probable also that the use of light wine as a beverage has fallen into disrepute because it has happened occasionally that both the palate and the pocket of the public at some time or other have been trifled with by unscrupulous dealers; we are convinced, however, that this is only a fractional reason, although it may well be accountable for the practical absence of a demand for light red wines on the hotel table. Nowadays it is quite exceptional to find claret called for at hotels, for the simple reasons that, firstly, the price asked for it is exorbitant and, secondly, the wine supplied is frequently of a very inferior quality, if, indeed, it is not sour and undrinkable. In these circumstances it is not surprising that whisky and water (plain or aerated), regarded, as it generally is, as being above suspicion, has come to be the common accompaniment to a meal at the hotel. We believe that if hotel proprietors would undertake to provide their patrons with a sound Médoc wine at a reasonable price—say, 2*s.* or 3*s.* a bottle—they would find the step very widely appreciated and a profitable one. The objection generally urged, however, is that such a scheme would leave no margin of profit. This seems to us unlikely when we call to mind the fact that in almost every little inn in France a bottle of good sound wine can be obtained for a franc or so. It may not be a wine of great quality or delicacy but, generally speaking, it is at least a "clean," wholesome, and genuine *vin ordinaire*. The small margin of profit theory is, moreover, illogical, since a bottle of whisky for which 5*s.* or 6*s.* are charged and which is made to last for perhaps a week, would leave surely a smaller margin of profit than a bottle of claret ordered with each meal.

But there are other factors which have led the public taste in this matter to disregard delicate light wines in favour of more potent beverages. Good sound claret is the most

[1] THE LANCET, Oct. 8th, 1904, p. 1035.

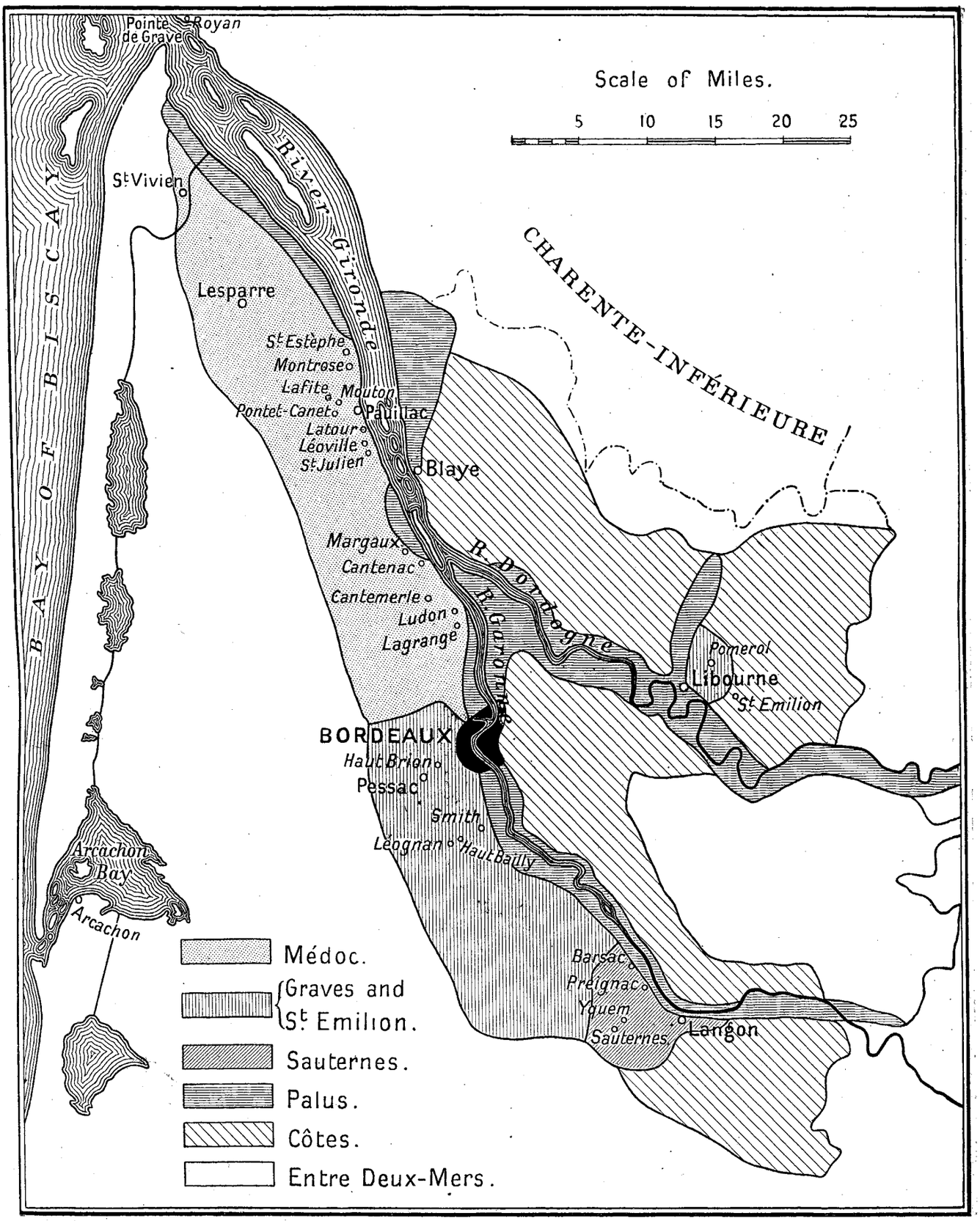
delicate as it is the least intoxicating of wines. The exquisite flavour of the Médoc wines in particular is easily spoilt and modern habits of living and of feeding conspire to blunt the delicate sense of the palate. The smoking of a cigarette or cigar, for example, invariably spoils the flavour of a choice claret and quite destroys the chance of appreciating and enjoying the taste and bouquet of a delicate wine. Coffee and liqueurs and even heavy wines, on the other hand, appear to many as agreeable accompaniments to smoking, the flavours of these liquids not being readily spoiled. Even so, these habits, whether we condemn them or not, should have no effect with respect to the claret consumed during a meal. Few now reserve a glass of Lafite or Margaux or Latour for after-dinner drinking, the use of port, liqueurs, or coffee, or of all three, having replaced the delicate and more interesting Château claret. It has been said that it is only the man of refined tastes who can appreciate to the full the refinements of a "classed" Médoc wine or who can differentiate between vinous vulgarity and delicacy, and this is a factor which tends to reduce the ranks of appreciative claret drinkers. Certainly claret is abandoned by many, it is to be feared, because, as *Mr. Punch* once put it, "you can't get no forrader on it." Continual spirit drinking undoubtedly interferes with the relish for the less potent but more "flavoury" wines. Simplicity of diet at the table, again, was more the rule when claret was in favour, whereas the present custom is to adopt a number of varied courses, comprising *hors d'œuvre*, piquant sauces, highly seasoned dishes, savouries, and so forth, which help to destroy the chances of appreciating the best characteristics of a really elegant and interesting wine. These are, at all events, some of the contributory causes of the decline in the consumption of light wines, and it is a question worth considering whether this decline, in view of the adoption of stronger wines or of ardent spirits, is not without an unfavourable influence on the health and *morale* of the people.

There are few social reformers who do not agree with the view that the less alcohol that a nation drinks the better. It surely follows that the less potent the alcoholic beverage is the better also, for in that case the physiological allowance of alcohol is less likely to be exceeded. The spirit-drinking habit as opposed to the indulgence in light natural wines is deplorable, especially when it is largely confined to potations between meals. It should be remembered that for all practical purposes, and certainly as compared with wine, whisky is pure alcohol and that therefore a mixture of whisky and water is a very different thing from wine, although the alcoholic strength of both may be the same. It may be remembered also that pure alcohol as such is never a natural product; it must be separated from the environment in which it is produced by means of the still. The physiological effect of ten ounces of whisky and water containing 10 per cent. of alcohol and ten ounces of, say, claret containing also 10 per cent. of alcohol is notoriously different. The former instantly produces a marked sense of stimulation and warmth in the stomach; the latter is exceedingly slow in producing a similar effect, if, indeed, it is produced at all, and yet the amount of alcohol in the two liquids is the same. The physiological effect of the alcohol in the wine is modified, no doubt, by the natural constituents of the wine, such as the acids, tannin, glycerine, extractives, and so forth. It would appear, therefore, that the alcohol in claret is not so readily diffusible as is the alcohol in a mixture of spirits and water. Sparkling wine, such as champagne, proves to be a readily diffusible stimulant, probably because the effervescence acts as a stimulant to the movements of the stomach. The physiological effect of alcohol in claret is in some way checked and claret is thus less rapidly stimulating than a mixture of spirits and water containing the same proportion of alcohol; in other words, the former is a gentle, while the latter is a rapid, stimulant. "It is a profound mistake," writes Dujardin Beaumetz, "to regard wine as a mere mixture of alcohol and water; it is a complete living entity, of which all the elements constitute an *ensemble* so complex and homogeneous that we cannot modify one or another without producing profound changes in the composition of the wine itself." Possibly the slow rate with which alcohol in claret is absorbed as compared with that of spirits and water is due to a difference of osmotic pressure exercised by the dissolved constituents of the wine. It is well known, at all events, that pure distilled water (that is, water which contains no salts) will act as a protoplasmic poison. If tissues or cells are placed in distilled water the water rapidly passes into the cells owing to the difference of osmotic pressure. The cells swell and may burst and die. This process in the stomach may lead to catarrh of the organ, the surface layers of the gastric epithelium undergo considerable swelling, salts may pass out, and the cells die and be cast off. Gastric catarrh, as is well known, is an invariable symptom of the confirmed spirit-drinker and it is conceivable that the purity of the alcohol which he constantly imbibes is a contributory factor to this catarrh owing to the difference of osmotic pressure between the alcohol and water and the gastric cells. On the other hand, the difference between osmotic pressure when wine is consumed must be relatively small owing to the extractives, glycerine, acids, and other constituents dissolved in the wine, and the passage of wine, unless it is strong and highly fortified, into the cells must be relatively slower. The placing of a slice of lemon in spirit and water would, in view of the phenomenon just referred to, tend to reduce the difference of osmotic pressure in a similar way.

In this connexion it is interesting to observe that there is a very excellent institution the members of which call themselves, we believe, semi-teetotalers who pledge themselves not to drink alcoholic beverages between meals. Common sense heartily approves of this form of abstinence from alcoholic liquors and though there are very many other cogent physiological considerations which clearly teach that such a course must be conducive to health, further proof of the discretion of such abstinence is furnished by the osmotic effects just described which indulgence in spirits is calculated to bring about. A consideration of this fact also teaches a lesson in regard to the drinking of light wine as opposed to the drinking of spirits. It would be interesting if those scientific men who condemn root and branch the use of alcohol in any form would conduct an experimental inquiry on the lines indicated and determine whether it is correct to assume that the physiological effect of alcohol in the form of wine is the same as when pure alcohol is given. There can be little question that a light natural wine is infinitely less harmful physiologically as regards alcohol than are ardent spirits. No better evidence in support of this can be cited than the fact that in spirit-drinking countries crime and disease ascribable to alcohol are the rule, while in countries where light wines are even freely consumed the evils arising from drink are the exception and drunkenness is comparatively unknown. So strongly has the fact impressed itself on certain communities that steps have been taken to encourage the drinking of light wines by reducing the duty on them in the hope that the consumption of spirits would be discouraged. In Paris, for example, the "octroi" on wines brought into the city have been taken off with the view of encouraging the drinking of light natural wine and of diminishing the vicious results occurring from the consumption of ardent alcoholic liquors, such as apéritifs, absinthe, and so on. The moderate drinking of claret in particular has been credited with diminishing the appetite for alcoholic drinks, and thus its use may have the salutary tendency of preserving a sober standard and of leading to the abandonment of the daily libation of powerful spirituous liquors. On temperance grounds it is a pity, we think, that the duty on really *light natural* wines imported into this country cannot be reduced to an even lower rate than it was some years ago. Really light wine might with advantage, we suggest, come under a lower scale of duty than is at present charged, the same rate now being put upon wines of a higher alcoholic strength than claret. In wine-producing countries, again, light natural cheap wine is consumed in large quantities, amounting to as much as two pints a day without any observed ill effects on the health. Sociologically, therefore, the decline in the consumption of light wines in favour of stronger drink demands serious consideration.

At the outset we stated that Bordeaux wines or clarets were never cheaper, more abundant, and purer than they are at the present time. It is necessary to examine carefully and

MAP OF THE WINE-PRODUCING DISTRICTS OF THE GIRONDE.



Area approximately = 65 x 80 miles.
Area under cultivation about 400,000 acres.

minutely into this statement in order to determine whether it can be justified by first of all looking into the facts connected with the production of red and white wines in the districts of which Bordeaux is the centre in the south-west of France; and, secondly, by submitting to the test of the palate and of chemical analysis samples of wine which are known to be genuine because obtained personally at the place of production and comparing the results with wines bought in the open market. Finally, it will be of interest to discuss the composition of wine in relation to its dietetic uses. We are aware, of course, that the composition of Bordeaux wines has been determined again and again by numerous observers and a great number of more or less trustworthy analyses have been published; nevertheless, we venture to think that in the work of the practical and scientific inquiry recently undertaken by our Special Commissioner there are presented some new features in analysis which are of special interest in connexion with the dietetic value of wines. We may resolve our inquiry therefore into the following order of investigation—namely, an inspection of the processes concerned in the production of Bordeaux wines, the normal composition and characteristics of genuine wines obtained personally at their source, and the general composition and characteristics of wines sold in the market as claret; finally a section is devoted to some points in connexion with their dietetic application.

THE WINE-PRODUCING AREAS OF THE MÉDOC, GRAVES, SAUTERNES, AND ST. EMILION DISTRICTS (GIRONDE).

The reputation of the wines of the Gironde has been built upon the yield of an area represented in some 400,000 acres under cultivation, while the complete district is not more than 65 miles by 80 miles, or an area of 5200 square miles. The whole wine-producing area of which we speak is, in fact, rather less than the area of the county of Yorkshire in England and yet it has furnished the world's claret supply for years and years and no other country in the world can compete with it in producing wine of equal delicacy, fragrance, and elegance. From the year 1880 onwards the production has steadily increased, although the area under cultivation has remained much the same; improved methods of cultivation have in fact resulted in a greater yield of fruit and hence of wine. Of course, some years show a diminished yield owing to unfavourable meteorological conditions, frost or wet it may be or insect ravages. The yield in 1880 was 36,000,000 gallons and in 1900, the most prolific year, it was 126,000,000 gallons; in 1904 it was 99,000,000 gallons; and in the last vintage (1905) the production promises to be about 95,000,000 gallons. The division of the entire department into six districts is shown in the map (p. 321). The districts are as follows and are indicated in the map by various shadings: Médoc, Graves, Sauternes, Côtes, Palus, and Entre-deux-Mers. Strictly speaking, the only district bordering on the Gironde, if we except certain small low-lying districts chiefly on the east bank and known as the "Palus," is Médoc itself. The name Gironde is applied to the estuary of that river and nearly 50 miles from the mouth it divides into the Dordogne and the Garonne at a point just above Blaye. The Garonne then traverses the districts where the wines of the Graves (white and red) and Sauternes district (white only) are produced, while the Dordogne runs through the valley on which borders the famous St. Emilion district (red wine). All these districts were visited by our Commissioner during the full operations of the 1905 vintage. The wines produced in these districts are broadly spoken of as the wines of the Gironde and the red wines are all included under the name of "claret."

Bordeaux may be called the city of cellars, every conceivable space underground being utilised for the storing of wine, and it may be imagined what immense stocks there are. The city lies at the southern extremity of the Médoc but is situated in the upper part of the Graves district. In Bordeaux the expression "*vin blanc et rouge*" means white and red wine produced in the districts shown on the map and lying around the city. The Médoc is less inland than the other districts and, in fact, is situated between the sea and the broad estuary of the Gironde and hence the word Médoc is probably a contraction of "In Medio Aquæ." In places this estuary is more than five miles wide. On the east side of the estuary and northwards lies the Charente Inférieure, bordering in its turn on the famous brandy-producing district, the Charente, with Cognac as its centre. By far the greater number of châteaux are situated in the Médoc which is the most productive area and certainly the wines of the Médoc are the most widely known. Mention need only be made of Châteaux Lafite, Margaux, Latour, Pontet-Canet, Mouton, Léoville, and so on, which are close to the towns of either St. Julien or Pauillac (the Gravesend, so to speak, of the Gironde). There are thousands of minor châteaux all devoted to the production of good wine, the quality varying according to the district in which the wine is produced. It is very remarkable to notice how sharply a district bearing superior wine is marked from a district bearing inferior wine. The districts may, in fact, be contiguous, but there is no doubt of the difference in the quality of the wine produced in each vineyard, though they may almost adjoin. The quality of a wine is, in fact, dependent upon soil and this varies considerably, even in the same districts. It is still the custom of the wine industry in the Médoc to adhere to a classification of "growths" which was drawn up very many years ago and which has been agreed upon as official and as a sort of hall-mark, and it is generally conceded that the division is a convenient one as regards standardising wines. It cannot be denied, however, that with improved attention to methods of cultivation during recent years growths placed outside this classification and called superior bourgeois or simply bourgeois really merit a place in the list, especially as this grouping into classes was made so long ago. Certainly several of the unclassed wines run the classed wines very closely as regards flavour and delicacy and amongst the former are many excellent cheap wines (from 12*s.* to 24*s.* a dozen) sold in this country.

The classification is as follows and next to the name of the château is given the name of the locality in which it is situated:—

FIRST GROWTHS (PREMIERS CRUS).

Château Lafite, Pauillac	Château Margaux, Margaux.
Château Latour ,,	

SECOND GROWTHS (SECONDS CRUS).

Château Mouton Rothschild, Pauillac.	Château Gruaud-Larose, Faure St. Julien.
,, Rauzan-Ségla, Margaux.	
,, Rauzan-Gassies ,,	,, Brane-Cantenac, Cantenac.
,, Léoville-Lascases, St. Julien.	,, Pichon-Longueville, Pauillac.
,, Léoville-Barton, St. Julien.	,, Pichon-Lalande, Pauillac.
,, Léoville Poyferré, St. Julien.	,, Ducru-Beaucaillou, St. Julien.
,, Durfort-Vivens, Margaux	
,, Lascombes ,,	,, Cos-d'Estournel, St. Estèphe.
,, Gruaud-Larose-Sarget, St. Julien.	,, Montrose, St. Estèphe.

THIRD GROWTHS (TROISIÈMES CRUS).

Château Giscours, Labarde.	Château Palmer, Cantenac.
,, Kirwan, Cantenac.	,, La Lagune, Ludon.
,, d'Issan ,,	,, Desmirail, Margaux.
,, Lagrange, St. Julien.	,, Calon Ségur, St. Estèphe.
,, Langoa ,,	,, Ferrière, Margaux.
,, Malescot-Saint-Exupéry, Margaux.	,, Marquis D'Alesme-Becker, Margaux.
,, Cantenac-Brown, Cantenac.	

FOURTH GROWTHS (QUATRIÈMES CRUS).

Château Saint-Pierre-Sevaistre, St. Julien.	Château Pouget, Cantenac.
	,, Latour-Carnet, St. Laurent.
,, Saint-Pierre-Bontemps, St. Julien.	,, Rochet, St. Estèphe.
,, Branaire-Ducru, St. Julien.	,, Beychevelle, St. Julien.
,, Talbot, St. Julien.	,, Marquis-de-Terme, Margaux.
,, Duhart-Milon, Pauillac.	,, Le Prieuré, Cantenac.

FIFTH GROWTHS (CINQUIÈMES CRUS).

Château Pontet-Canet, Pauillac.	Château Le-Tertre, Arsac.
,, Batailley ,,	,, Haut-Bages, Pauillac.
,, Grand-Puy-Lacoste, Pauillac.	,, Pédesclaux ,,
,, Grand-Puy-Ducasse, Pauillac.	,, Belgrave, St. Laurent.
	,, Camensac ,,
,, Lynch-Bages, Pauillac.	,, Cos-Labory, St. Estèphe.
,, Lynch-Moussas ,,	,, Calve-Croizet-Bages, Pauillac.
,, Dauzac, Labarde.	
,, Mouton-d'Armailhacq, Pauillac.	,, Cantemerle, Macau.

The Graves district borders on the river Garonne and produces both red and white wines. Amongst the favourite red wines are those of Château Haut Brion, just west of, and quite close to, Bordeaux, which in fact is classed in the first division; Château Smith, Haut Lafitte, and Château Haut Bailly. The classification of the white wines of the Gironde relates to the wines of the Sauternes, the Grand first growth being that of the world-famous Château Yquem, while other wines enjoying distinction in the first class are those from La-Tour-Blanch, Peyraguey, Vigneau, and Rabaut in the Bommes district; Château Coutet, Climens at Barsac, Château Suduiraut at Preignac, Château Guiraud at Sauternes, and Château Rieussec at Fargues. In the second class are wines from Château Mirat (Barsac), Doisy (Barsac), Peyxotto (Bommes), D'Arche Filhot (Sauternes), Broustet-Nérac (Barsac), Caillou (Barsac), Suau (Barsac), Malle (Preignac), Romer (Preignac), and Lamothe (Sauternes). The chief town in the Sauternes district is Langon, which is beautifully situated on the banks of the Garonne. The most important wines produced in the Côtes are those in the district of St. Emilion. They are often called, on account of their full body and generous character, the burgundies of the Gironde. Amongst famous growths are Châteaux Ausone, Cheval Blanc, Bel-Air, and Pavie. Close by is Pomerol which also produces wines of estimable character. St. Emilion is a most interesting and picturesque town situated in a charming district of hills and vales, about five miles east of Libourne on the river Dordogne, the bridge over the river being part of the national road running from Bordeaux to Paris. All the districts just described were visited by our Commissioner during vintage time. And we may now pass to the methods of making the wine from the grape as he saw them practised in these districts.

FIG. 1.

The gathering of the grapes.

WINE MAKING IN THE GIRONDE.

There is surprisingly little to describe in regard to the method of making wines in the Gironde for the excellent reason that it is simplicity itself and we doubt whether any other wine than claret can claim to be left so entirely to purely natural processes. Indeed, claret makes itself without even the intervention of a press in some cases, for in the ordinary processes of picking, carting of the grapes, and separating the stalks some of the juice is liberated; fermentation rapidly sets in and the berries that happen to remain whole in the vat burst, their juice joining in the fermentation already established. The grape is black, with a diameter of about that of a threepenny piece, and in a healthy state is usually covered with a strong bloom. The colour of claret is entirely due to the skins and if these were omitted from the vat practically a white wine would result. All grape juice is white whether the grape is white or black. Vintage time in the Médoc affords a very interesting and picturesque sight. We reproduce some photographs illustrating in Fig. 1 the gathering of the grapes, in Fig. 2 their removal in carts drawn by oxen to the *cuvier* (Fig. 3) the place in which the grapes are pressed and the wine is stored in vats.

As already stated, in some cases it is not necessary that the grapes should be pressed at all; so much of the juice escapes by the pressure of the fruit itself and during the process of separating the stalks that the semi-liquid mass containing whole fruit is transferred straight away into the vat without further attention. In the majority of cases, however, the grapes are carefully picked and pressed but the skins are always put into the juice in the great vats. We give an illustration in Fig. 4 of a typical *pressoir*. Fermentation steadily proceeds in these vats which are closed in order to keep the generated carbonic acid gas as much as possible in the vat and thus to protect the wine that is developing from the action of the air. The escape of gas is provided for by a small pipe dipping into a water seal. The bubbling noise of the gas passing through the water in an otherwise perfectly quiet *cuvier*, where there may be a dozen vats of immense capacity each contributing its volume, is a strange and impressive sound. The primary fermentation being concluded, after about ten days the young wine is drawn off (*décuvage*) and eventually transferred to scrupulously clean hogsheads (barriques). The hogsheads are placed in the cellar where the wine is jealously watched during its development and the only care that remains to be bestowed upon it is in the racking (drawing off the clear wine from the lees or residues) which is done as often as there is occasion, according, in fact, to the development of the wine. A comparatively quiet secondary fermentation succeeds the first but soon subsides until practically the whole of the grape sugar is exhausted. There is little doubt that careful and well-timed racking is a very important factor in the production of a good wine and any neglect to carry out this simple operation may make all the difference between success and failure. With ordinary wines bottling may be commenced at the end of the second year, but as a rule fine and full-bodied wines are not bottled until the end of the third year or fourth year or even after a longer period.

Such, in brief, is the story of the making of claret from the juice of the grape and the entire process is extremely simple, being effected from beginning to end by what practically amounts to purely natural agencies. The grape juice ferments until fermentation ceases and in order to gain a clear and brilliant product the resulting wine is simply poured off from certain insoluble matters, as from time to time they subside and are thrown out by the alcohol produced. The degree of cleanness and brilliancy depends upon the care and regularity with which the racking is done. The word claret is probably derived from "*clairé*," cleared or clarified (Latin "*clarus*," clear). It was but a step from the old French participle "*clairé*" to the adjectival noun "*clairet*" or, as we have it, Anglicised, "claret." The clearing process is often assisted by fining the wine with white of egg, which process adds nothing foreign to the ultimate wine but merely withdraws matters identical with those thrown out in the ordinary course of events in the natural deposit. There are, of course, certain minor details connected with the management of wine during its development but we have confined our account to the principal and essential steps in the simple operation. Suffice it to add that at no stage in the

making of claret is there any recourse to the use of artificial agents and genuine claret is never fortified by the addition of spirit. In short, as we have said, claret is the simplest type of wine and the product of purely natural agencies, requiring no additions whatever to fit it for consumption or to adapt it to the public taste.

The red wines in the Graves district are produced much in the same simple way, as is also white claret (made from white grapes), while in the Sauternes district the method of wine making is totally different. The white grape of the Sauternes is allowed to get thoroughly ripe until, in fact, it shows signs of wrinkling up and rotting and consequently the vintage is later than in the Médoc. The grapes are picked with very great care and discrimination off the bunch singly grape by grape and after a thin mould has formed upon them. In the press house they are first trodden under foot and then by machinery, the expressed juice being collected and put straight into the hogshead in which the fermentation takes place, which generally lasts several weeks. The wine becomes bright and fermentation is arrested partly by the alcohol generated and partly by the onset of the cold weather. The grape juice, as may be anticipated, is very rich in sugar and the best Sauternes are sweet, and unless certain precautions are taken, as by burning some sulphur in the casks, fermentation will readily start again on the slightest provocation. Wines for export are also "sulphured" otherwise the casks containing them would imply, and in wine are also found, besides alcohol, the additional products of fermentation, such as glycerine, ethers, and higher alcohols. Moreover, as the alcohol develops it exerts a solvent action on the extractive matters of the skin and thus tannin and colouring matter appear in the wine. A sample of grape juice taken in the Médoc during the 1905 vintage gave the following results (grammes per 100 cubic centimetres) on analysis in THE LANCET Laboratory. Side by side with this analysis is placed an average analysis of a Médoc wine. A comparison of the two shows broadly the changes in composition effected by fermentation.

The Composition of Grape Juice compared with Wine.

	Grape Juice.	Claret.
Total solid matters	23·12	2·55
Sugar	21·80	0·13
Alcohol	—	9·83
Water	76·87	87·61
Glycerine	—	0·642
Tannin	traces.	0·238
Albuminoid (N × 6·3)	0·30	0·278
Total volatile acidity calculated as acetic acid	—	0·127
Total fixed acidity reckoned as tartaric acid	0·69	0·460
Potassium tartrate	0·34	0·166
Total mineral matter	0·34	0·220

FIG. 2.

Carting the grapes.

burst. There are, however, some very agreeable dry wines produced also in the Sauternes, but the most famous, as that of Yquem, are sweet, full, and generous and carry a high perfume. We deal with the character and composition of these wines in a section devoted to their analysis further on.

It may be added, in concluding this description of the wine-making processes of the Gironde, that no attempt is made to keep the processes away from public scrutiny and anyone is at liberty to visit the *cuvier* during the busy time of pressing the grapes; indeed, the entire operations during vintage, as during the harvest of corn in England, may be watched in detail from the roadway, and there are scores of presshouses opening on to the highway from which the pressing of the grapes may be seen as well as the processes involved in the consignment of the juice to the vats.

THE COMPOSITION OF THE WINES OF THE GIRONDE.

Millions of gallons of grape juice would be annually wasted if fermentation did not step in, which it does the moment the juice is set free from the fruit and preserves it in the form of wine. Fermentation may therefore be regarded as a preserving process in which the development of alcohol corresponding to the amount of sugar present in the juice is the chief factor. Broadly speaking, wine is grape juice with the sugar replaced by alcohol. The process of fermentation is, however, more complex than this statement

It should be added that the grape juice, previously to its despatch to THE LANCET Laboratory, was sterilised by heating immediately it left the press and certain albuminoid matters, gums, &c., had coagulated. These were collected, dried, and weighed, the sediment amounting to 1·02 grammes per 100 cubic centimetres of juice. The sediment contained mineral matter, 15·64 per cent.; albuminoid matters, 16·00 per cent.; and gums, fibre, and acids, 68·36 per cent. The coagulum obtained on sterilising grape juice bears a close resemblance to the composition of wine lees. The juice was slightly tinged red and contained merely traces of tannin.

The normal composition of genuine clarets is shown in Table A. The specimens were secured personally in Bordeaux by our Commissioner and an attempt was made to select types representative of the various districts shown in the map. They include the red wines grown in the districts of St. Estèphe, Pauillac, Margaux, St. Julien, Cantenac, and Labarde in the Médoc, Pessac and Léognan in the Graves district, and Pomerol and St. Emilion in the St. Emilion district. From time to time a considerable number of analyses of claret have been published in English scientific journals but hitherto these analyses have omitted certain important items which the present analyses supply, we believe, for the first time.

The results may be briefly summarised. The alcohol in claret rarely exceeds 10 per cent. by weight and on

the whole it varies but little either on one side or the other of 10 per cent. by weight or 12·40 per cent. by volume. The extractive matters in claret are, as a rule, a fairly constant quantity, averaging 2·55 per cent. The figure is somewhat lower for old wines, while it is a little higher for the St. Emilion and Graves wines. Wines of delicate character, as a rule, seldom contain more than 2·50 per cent. of solid matters in solution. The average amount of glycerine in clarets is 0·642 per cent., but the amount varies in accordance with the nature of the wine, the maximum, as a rule, being just short of 1 per cent. and the minimum 0·43 per cent. The wines from the St. Estèphe district are generally characterised by containing the highest quantity—i.e., over 0·9 per cent. This is an interesting feature of St. Estèphe wines and almost serves, in our experience, as a hall mark. Whenever we purchased in the open market, and we obtained several samples in this way, a wine described as St. Estèphe, it always showed this relatively high proportion of glycerine. In old wines the glycerine is likely to colour, as a rule, show a relatively small proportion of nitrogenous substances and *vice versâ*, and in a wine decolourised by animal charcoal there is practically no nitrogen at all. The wines showing the highest proportion of nitrogenous bodies were No. 3 and No. 10 in Table A, and these showed the highest intensity of colour. On the other hand, the wine showing the smallest amount of nitrogen—namely, No. 1 in the table—showed the least intensity of colour. The nitrogen diminishes again in old wines due to loss by deposition and their colour is correspondingly reduced. The inference is that in red wines the nitrogen is part and parcel of, at any rate, some of the colouring constituents and it is of interest to add that the grape skin contains 1·45 per cent. of nitrogen which, calculated as albuminoid, amounts to 9·14 per cent. The average amount of albuminoid (N × 6·3) in claret is 0·278, extreme points being 0·395 and 0·105. We shall return to this question of the amount of nitrogenous constituents present in wine, since they appear to affect the digestibility of wine in direct proportion to their amount

FIG. 3.

The press and vat-house.

exceed 0·6 or 0·7 per cent. Glycerine is, of course, a perfectly normal product of vinous fermentation and is probably a contributory factor to the preservation and conditioning of a wine and as well tending to give it body and sweetness. The chief preservative in wine, however, must be the alcohol, since de-alcoholised wine rapidly changes and gets mouldy. The sugar in clarets is practically constant, rarely exceeding 0·2 per cent., the average being as low as 0·130 per cent. Clarets contain, as a rule, less sugar than do white wines. Tannin is also a fairly constant quantity and averages 0·238 per cent. The amount is reduced by age or by fining. There appears, however, to be no relation between the amount of tannin and nitrogenous substances in a wine. The tannin, colouring matter, and nitrogenous substances share one common property in wine, since when red wine is decolourised with animal charcoal all three are found to be practically absent in the colourless wine.

The amounts of nitrogenous matters in claret vary somewhat widely and a relation seems to exist directly between the total nitrogen and the intensity of colour. Wines of low and, as a rule, as colour diminishes the less is the interference caused by the wine with the digestive processes. It would follow that the young highly coloured wines are less digestible than the old wines in which the colour has largely disappeared. There are, however, other factors in the composition of wine as we shall presently see which may discount such a deduction or the idea of any relationship existing between colour and digestibility.

It is curious that claret is so often regarded as an acid or a sour wine. As a matter of fact it is the least acid of all wines and is certainly less acid than white wine. Claret is the "driest" of wines, there being practically no sugar present to disguise the small degree of acidity that exists. The palatability of sparkling wines such as champagne is considerably diminished when the wine is excessively dry and they appear intensely acid when the sugar is entirely removed. Of course, claret easily becomes sour if it is not securely corked or when the means to keep it away from the oxidising action of the air is defective. A good delicate mature claret will not keep; young, rough, vigorous wine, on the other hand, will

last for days after it has been poured out of the bottle. This serves as a simple but correct way of differentiating a wine of delicate character from a coarse one. The amount of fixed acidity in clarets expressed in terms of tartaric acid seldom exceeds 0·45 per cent., the average being 0·40 per cent., and in a sound wine the volatile acidity reckoned as acetic acid is seldom more than 0·17 per cent., the average being 0·127 per cent. The amount of potassium tartrate in claret is fairly constant also, the average being 0·166 per cent. It increases in full-bodied wines. The mineral matter varies between limits of 0·10 and 0·30 per cent. Summing up, it may be stated that, generally speaking, clarets, even from different districts, show a fairly uniform composition, and the small variations that are seen to occur may be accounted for by the special circumstances in which the wine is produced, as to whether it is old, delicate, full-bodied, coarse, highly or thinly coloured, and so forth. The generous and somewhat full character in Table B. Besides those given in the table we have purchased many other samples which were submitted not to analysis but to the palate of an expert who pronounced them all to be wines possessing the genuine Bordeaux characteristics, though in some instances his opinion was qualified by such remarks as "perfectly genuine wine but not of great quality," "thin wine," "somewhat coarse," and so on, but all were described correctly as claret—that is, wine produced in the Médoc and other districts of the Gironde. Moreover, the price in some instances was not more than 12*s.* a dozen, comprising samples of really good *vin ordinaire*, while quite good claret with delicacy and bouquet and attractive flavour was purchased at from 15*s.* to 30*s.* a dozen.

On the whole it is satisfactory and gratifying to be able to report that the public get what they ask for when they purchase claret. There are, however, exceptions which we will point out although if our observations are followed there

TABLE A.—ANALYSES OF GENUINE CLARETS.

(*Results in Grammes per 100 c.c.*)

Description.	Alcohol by weight.	Alcohol by volume.	Water.	Extractives.	Glycerine.	Sugar.	Tannin.	Proteid = N × 6·3.	Total volatile acidity as acetic acid.	Total fixed acidity as tartaric acid.	Probable real tartaric acid.*	Potassium tartrate.	Total mineral matter.
Leoville Lascases. 1. St. Julien, 1890	9·21	11·44	88·29	2·50	0·430	0·140	0·236	0·105	0·138	0·41	0·35	0·124	0·20
Rauzan Segla. 2. Margaux, 1896	9·29	11·52	88·17	2·54	0·561	0·125	0·236	0·176	0·159	0·41	0·35	0·192	0 25
Chateau Palmer. 3. Cautenac, 1899	10·38	12·87	86·98	2·64	0·683	0·130	0·200	0 356	0·111	0·45	0·41	0 060	0·14
Chateau Langou. 4. St. Julien, 1896	9·79	12·13	87·61	2·60	0·670	0 111	0·236	0·282	0·129	0·46	0·40	0·150	0 20
Chateau d'Issan. 5. Cautenac, 1899	9·57	11·87	87·53	2 90	0·620	0·110	0·259	0·336	0·135	0·48	0·41	0·250	0·25
Montrose. 6. St. Estéphe, 1899	10·06	11·52	87·38	2·56	0·910	0·160	0·188	0·275	0·135	0·48	0·43	0·180	0 25
Chateau Latour. 7. Pauillac, 1880	10·77	13·34	86·83	2·40	0·845	0·140	0·236	0·229	0·108	0·50	0·44	0 226	0 28
Petrus Pomerol. 8. St. Emilion, 1900	9·36	11·61	87·84	2·80	0·646	0·170	0·318	0·211	0·174	0·41	0·33	0·101	0 10
Chateau Haut Brion. 9. Graves Red, 1899	10·23	12·68	86·77	3·00	0·756	0·160	0·306	0·324	0·129	0·48	0 40	0·146	0 25
Chateau Pavie. 10. St. Emilion, 1899	10·16	12·57	86·79	3·05	0·550	0·100	0 212	0·395	0·102	0·52	0·47	0·259	0 30
Chateau Dauzac. 11. Laborde, 1899	9·29	11·52	88·25	2·46	0·580	0·135	0·200	0·388	0·132	0·46	0·42	0·158	0·26
Chateau Loudenne. 12. St. Yzans	9·96	12·35	87·38	2 66	0·620	0·143	0·236	0·299	0·102	0·46	0·40	0·180	0·23
Ducru Beaucaillou. 13. St. Julien, 1893	9·64	11·96	88·06	2·30	0·665	0·090	0·236	0·317	0·138	0·50	0·44	0·200	0·30
Chateau Lafite. 14. Pauillac, 1896	9·96	12·30	88 74	1·30	0·462	0·120	0·236	0·211	0·096	0·49	0·43	0·100	0·11
Mean results	9·83	12·12	87·61	2·55	0 642	0·130	0 238	0·278	0·127	0·46	0·40	0 166	0 22

* This column gives the total acidity less that due to tannic acid.

of a St. Estèphe, a red Graves, or a St. Emilion wine (the last being often called the burgundy of the Gironde) has its counterpart in a slight increase in alcoholic strength, in the amount of extractives, tannin, nitrogenous bodies and intensity of colour. The delicate wines, on the other hand, show a less robust constitution even from an analytical point of view. It is, however, chiefly the æsthetic qualities of a wine which give it the greatest esteem and up to the present chemical analysis can throw little light upon those elements which determine the fragrance, bouquet, and flavour of a wine. The estimation of the secondary products of fermentation (higher alcohols, ethers, and aldehydes) gives, however, some interesting results, as will be seen further on.

Having presented what may be regarded as the normal results of analysis given by clarets which we know to be genuine, we may next proceed to apply the same methods to the examination of wines described as clarets bought in the open market. The analytical results will be found should be no difficulty in avoiding these exceptions. It should be stated that when purchasing these samples which proved to be genuine we made no special endeavour to procure samples which were suspicious either by being sold at an absurdly low price, say at 6½*d.* a bottle, or by bearing a label which conveyed nothing. Later, however, we turned our attention to abnormally cheap wines and we found that for the most part these were being sold at cheap Italian restaurants. We append the analysis of samples in Table C. We are convinced that even many of these are genuine wines inasmuch as they are made from grape juice, not, however, in the Médoc but most probably in London. They are, in fact, the so-called "basis wines." As will be readily seen from the analysis, they are characterised by a high amount of alcohol (due to added spirit), high sugar and low tannin, low nitrogen and feeble colour. In some cases the addition of glycerine is obvious. Grape juice contains little tannin and, of course, is white in colour. The colour of the basis wine may be derived from a small

TABLE B.—ANALYSES OF TYPES OF CLARETS BOUGHT IN THE OPEN MARKET.

(Results in Grammes per 100 c c)

Description.	Alcohol by weight.	Alcohol by volume.	Water.	Extractives.	Glycerine.	Sugar.	Tannin.	Proteid = N × 6·3.	Total volatile acidity as acetic acid.	Total fixed acidity as tartaric acid.	Probable real tartaric acid.*	Potassium tartrate.	Total mineral matter.	Observations.
Claret. 1. Vin Ordinaire	10·77	13·34	87·00	2·23	0·624	0·111	0·236	0·246	0·111	0·55	0·49	0·113	0·20	Sound natural wine.
2. Médoc	10·00	12·40	87·10	2·90	0·706	0·340	0 177	0·204	0 090	0·48	0 45	0·124	0·19	A non-acid, agreeable, soft wine and undoubtedly genuine.
St. Vivien. 3. Bourgeois Wine	9·50	11·79	87·40	3·10	0·980	0·100	0·236	0·141	0·126	0·50	0·44	0·113	0·18	A genuine wine but somewhat featureless.
Claret. 4. Bourgeois Wine	9·79	12·13	87·26	2 95	0 790	0·151	0·177	0·194	0·084	0 48	0·43	0·180	0·20	A type of excellent vin ordinaire.
Cotes. 5. Vin Ordinaire	8·14	10·12	89·96	1 90	0·584	0·100	0·200	0·176	0·180	0·39	0·35	0 056	0·10	Genuine wine but rather poor quality.
Château Montrose. 6. St. Estèphe, 1899... ...	10·38	12·87	87·07	2·55	0·970	0·103	0·283	0 211	0·168	0·40	0 33	0·135	0·12	An elegant wine.
Château Lafite, 7. Pauillac, 1895.	10·06	11·52	87·40	2·54	0·780	0 090	0·330	0 229	0·165	0·39	0·31	0·200	0 23	A pure, soft, flavoury wine.
Mean results	9·80	12·02	87·59	2·59	0·776	0·142	0 232	0·201	0·132	0·45	0·40	0 131	0·17	—

* This column gives the total acidity less that due to tannic acid.

TABLE C.—ANALYSES OF PROBABLY BRITISH MADE WINES LABELED AS MÉDOC WINE.

(Results in Grammes per 100 c.c.)

Description.	Alcohol by weight.	Alcohol by volume.	Water.	Extractives.	Glycerine.	Sugar.	Tannin.	Proteid = N × 6·3.	Total volatile acidity as acetic acid.	Total fixed acidity as tartaric acid.	Probable real tartaric acid.*	Potassium tartrate.	Total mineral matter.	Observations.
1. Médoc	9·86	12·22	87·52	2 62	0·968	0·18	0·118	0·194	0·195	0 63	0·600	0·113	0·15	Fermented grape juice but not a Médoc wine.
2. Médoc	9·00	11·17	88·42	2·58	0·360	0·10	0·200	0·141	0·177	0·49	0·450	0·090	0·32	Fermented grape juice with uninteresting flavour.
3. Médoc	10·85	13·43	87·40	1·75	0·373	0·20	0·150	0·169	0·234	0·30	0·250	0·100	0·10	Fermented grape juice but not a Médoc wine.
4. St. Estèphe	12·38	15·30	84·28	3 34	0·901	0 55	0·236	0·070	0·171	0·57	0·510	0·056	0·13	Probably an unsound Médoc wine fortified with spirit.
Mean results	10·52	13·03	86·90	2·57	0·650	0·25	0·176	0·143	0 194	0·49	0·450	0·089	0·17	—

* This column gives the total acidity less that due to tannic acid.

TABLE D.—ANALYSES OF WHITE WINES.

(Results in Grammes per 100 c c)

Description.	Alcohol by weight.	Alcohol by volume.	Water.	Extractives.	Glycerine.	Sugar.	Tannin.	Proteid = N × 6·3.	Total volatile acidity as acetic acid.	Total fixed acidity as tartaric acid.	Potassium tartrate.	Total mineral matter.	Observations.
Château de Tastes. 1. Sauternes	12·85	15·86	69·60	17 50	0·853	14·000	Trace	0·356	0·090	0·48	0·339	0·36	A sweet wine with exquisite flavour.
Château de Rayne. 2. Sauternes	12·31	15·21	77·59	10·10	0·799	7·260	Trace	0·652	0·141	0·40	0·158	0·38	Less sweet than the previous wine but with excellent æsthetic qualities.
Petites Graves	8·71	10·82	88·84	2·45	0·541	0·263	Trace	0·141	0·135	0·73	0·169	0·23	A "dry," "clean" wine and of light alcoholic strength.
Grand Sec. 4. 1er Vin de Graves	11·47	14·18	86·28	2·25	0·605	0·240	Trace	0 246	0·129	0·63	0·079	0·20	A very agreeable wine with delicate flavour.

addition of a highly coloured wine or from the skins of other fruits. If wine is defined to be the fermented juice of the grape then such preparations may be entitled to the designation of wine, but it is obviously misleading to label them Bordeaux or Médoc wine as is invariably done and in some instances the name of a hypothetical château is printed on the label. Shippers and agents would materially protect the public against this form of fraud if they would make it a universal rule to have affixed to the bottle a label with some kind of guarantee printed upon it in the form of the name of the producer, importer, or agent. The importation of grape juice of course avoids the spirit duties and we are surprised that the revenue authorities do not take action summarily in the matter, since by this device they are deprived of so much duty on wine made necessarily from material imported from abroad. In any case, such wines should be labelled compulsorily with the words "British made." It should be mentioned, however, that a vigorous and successful action has been recently inaugurated against the sale of fraudulent wines of the class described and in Bordeaux a powerful "syndicate of defence," comprising some of the largest wine growers in France, has been formed with the view of protecting the public against this species of imposition.

As we have said, however, the result of our inquiry has shown that the proportion of mis-named wines offered to the public as compared with the genuine article is exceedingly small and suspicion, having regard to the duties on foreign wines, will easily fall on a so-called genuine Médoc which claims to be valued at a little over 6*d.* a bottle. But perfectly good, wholesome, genuine Médoc wine is obtainable at 1*s.* per bottle which, while bearing the characteristics of a Bordeaux wine, is simple in kind and somewhat short of the æsthetic qualities of more expensive wines. The price of a wine is, of course, entirely dependent on these qualities: it is flavour that is paid for in the case of wine, just as it is in so many other articles of consumption. The palate rules the price, but wine is wine after all. The cheaper clarets are produced in the north of the Médoc, in the islands of the Gironde, in the districts around Blaye, on the east bank of the Gironde, and from the "Palus" or low-lying districts, and are commonly drinkable in the second year. They are sound, wholesome wines of the bourgeois type and, of course, less delicate than the "classed" wines produced in the localities of Pauillac, St. Julien, or Margaux.

The land of white claret is chiefly the renowned district of Sauternes, though a considerable amount of white wines is grown in the bordering district of Graves. Strictly speaking, "vin des Graves" applies to those wines, both red and white, produced in the Graves district, although in this country the designation "Graves" nearly always implies a white wine. White claret is more often vin des Sauternes grown in the neighbourhood of Barsac, Priegnac, and Bommes. The composition of the wines of the Sauternes district shows wide variations, chiefly in regard to alcohol and sugar, and depends upon the variations in the quality of the grape. Broadly, there are three descriptions of wine—the very sweet (almost syrupy wines, recalling Tokay), the moderately sweet, and the dry. Examples of all three are given in Table D. As will be seen, the chief point of difference in the composition of a red and a white wine is the practical absence of tannin and colour in the latter, the juice being fermented after the removal of the skins. The "dry" wines in other respects resemble red wines, the amount of sugar, alcohol, and acidity, however, being in general higher while the percentage of albuminoids is lower consistently, as it were, with the absence of red colour. A somewhat high proportion of glycerine in the full, sweet wines will be observed to increase *pari passu* with the increased alcoholic strength. The sweet wines also contain a relatively high percentage of albuminoids.

We may next call attention to Table E in which the amounts of ethers, higher alcohols, and aldehydes in the various wines of the Gironde are compared. We believe that this is the first time that the analysis of wines has referred to these constituents and the results are of interest, first of all in showing that the higher alcohols and ethers in the wine are most frequently present in much the same ratio as in brandy—which if genuine is the distillate of wine in a simple still; and secondly, the amount of higher alcohols present increases with the age of the wine and when they occur in relatively large proportion the indication is generally in favour of a heavy full-bodied wine. The full sweet Sauternes, for example No. 15, contain as much as 500 grammes of higher alcohols per 100 litres of alcohol present and a high figure is also reached by the dry Sauternes, while the average of a number of light clarets is between 160 and 109 grammes per 100 litres of alcohol present, a figure which is given by ordinary genuine brandies. The somewhat heavy character of Sauternes apart from their relatively high alcoholic strength is probably in part due to the development of alcohols of the higher series. The ethers in Sauternes wines are, again, generally speaking, higher in amount than in the Médoc wines. The aldehydes vary but little, the highest (a St. Emilion wine) being 7·00 and the lowest (an old Latour wine) 3·50. In certain instances a high proportion of higher alcohols corresponds with a relatively high amount of glycerine except in the case of wines of doubtful origin or

TABLE E.—*Volatile Ethers, Higher Alcohols, and Aldehydes in Clarets, &c., in Grammes per 100 Litres of Alcohol present.*

Description.	Volatile ethers calculated as ethyl acetate.	Higher alcohols.	Aldehydes.	Observations.
Leoville-Lascases. 1. St. Julien, 1890... ...	281·00	116·00	5·80	—
Rauzan-Ségla. 2. Margaux, 1896	286·00	163·00	4·70	—
Château Palmer. 3. Cantenac, 1899	252·00	170·00	5·20	—
Château Langoa. 4. St. Julien, 1896... ...	265·00	227·00	4·50	—
Château d'Issan. 5. Cantenac, 1899	284·00	160·00	5·00	—
Montrose St. Estèphe. 6. Médoc, 1899	258·00	212·00	5 30	—
Château Latour. 7. Pauillac, 1880	286·00	300·00	3·50	—
Petrus Pomerol. 8. St. Emilion, 1900 ...	260 00	232·00	7·00	
Château Haut Brion. 9. Graves Red, 1899 ...	228·00	146·00	4·70	—
Château Pavie. 10. St. Emilion, 1899 ...	228·00	250·00	6·20	—
Château Dauzac. 11. Labarde, 1899	303 00	209·00	4·60	—
Château La Lagune. 12. Ludon, 1890	190·00	217·00	5 40	—
Ducru Beaucaillou. 13. St. Julien, 1893... ...	400·00	264·00	5·00	—
Château Lafite. 14. Pauillac, 1896	309·00	319·00	5·30	—
Château de Taste. 15. Sauternes	377·00	564·00	4·30	—
De Rayne Vigneau. 16. Sauternes	335·00	363·00	5·90	—
Petites Graves 17. Vin Ordinaire	297·00	500·00	5·60	—
Grand Sec. 18. 1er Vin de Graves ...	463·00	184·00	5·40	—
Claret. 19. Vin Ordinaire	232·00	137 00	5·00	Purchased in London.
Claret. 20. Bourgeois Wine ...	270·00	109·00	Nil.	,,
St. Vivien. 21. Bourgeois Wine ...	300·00	109·00	5·40	,,
Claret. 22. Bourgeois Wine ...	245·00	109 00	5·40	,,
Côtes. 23. Vin Ordinaire	311·00	160·00	6·70	,,
24. Médoc	326·00	170·00	6·00	,,
Château Montrose. 25. St. Estèphe, 1899 ...	270·00	200·00	5·00	,,
Château Lafite. 26. Pauillac, 1895	306·00	180 00	5·00	,,

basis wines to which it is probable that glycerine is sometimes added.

SOME EXPERIMENTS BEARING UPON THE EFFECTS OF CLARET ON THE CHEMICAL PROCESS OF DIGESTION.

In recording the results showing the effects of claret and other wines upon the processes of digestion it should be stated that the present experiments were of a purely chemical and not physiological kind. That is to say, the experiments were conducted *in vitro*, employing artificial gastric juice and pancreatic juice respectively. Nevertheless, the results are of comparative interest as indicating at any rate the influence of wine and of claret in particular on the chemical process of digestion. Whatever may be the effect shown in experiments conducted *in vitro*, it must be remembered that *in vivo* good wine has a favourable influence upon the gastric function, which would, it is not unlikely, more than compensate for any discrepancy seen to exist in an experiment in which the effect of wine upon the merely hydrolysing action of a ferment—pepsin or pancreatin—is tried. It is generally conceded that the net result of a moderate use of wines, and especially light wines, with meals is favourable because they induce an increase of appetite and gastric secretion, and thus it is conceivable that even if the mere chemical process of digestion is interfered with at all such interference would be completely balanced by the healthy stimulus given to the gastric function. Upon this effect of wines is, in fact, based their use in health and disease. It will be seen from Table F that light natural clarets have only a trifling inhibitory and practically negligible effect upon the chemical activity of the gastric ferment, while there is a small retarding influence in the case of pancreatic digestion. Apparently those clarets which are of a light delicate character retard the processes of chemical digestion least, and in this category we must, of course, place the older "classed" wines. Nevertheless, wines of the *vin ordinaire* type show only a small disturbing effect upon digestion, an effect which probably is not produced at all in the living organism owing to the stimulating action of wine on the gastric function. In Table G also are included the results of two experiments with a solution containing amounts of tannin occurring in different clarets. Contrary to expectation, these solutions showed practically no inhibitory effect on the digestion of albumin. According to this the tannin of red wine would not appear to interfere with the process of digestion and in this connexion it may be called to mind that an ordinary cupful of tea contains a good deal more tannin than does an equal volume of claret. Also in the same table the results are shown of the effects on digestion of pure grape juice grown in the Médoc. Here there is evidently a marked inhibitory action which is diminished, however, as the grape juice is diluted with water.

When the activity of pepsin is interfered with at all by red wines it is generally due, we find, to the colouring matter of the wine, for as the intensity of the colour increases so is the inhibitory effect of the wine upon the chemical process of digestion increased. And when the colour of the wine is taken out with animal charcoal we found (see number 18 in Table F) that the decolourised wine has no appreciably interfering effect at all upon the digestive process. As already pointed out, animal charcoal extracts from wine its colouring matters, its nitrogenous bodies, and its tannin, and since the nitrogenous bodies increase directly with the intensity of the colour and tannin has very little effect upon the digestive process, it would appear that the chief constituent of red wine that is inhibitory to the chemical process of digestion is a nitrogenous body closely associated with the colouring matter. This result is very interesting as tending to indicate that old wines with low intensity of colour and delicacy of character are, from the point of view of dietetics, better than young, robust, highly coloured wines. On the other hand, old wines are richer in volatile bodies other than alcohol, such as ethers and higher alcohols, than are young wines, and in some cases, at any rate, these bodies seem to have a slight retarding influence on the digestive process. Colour being absent in white wines these when of a light character have a smaller inhibitory effect as a rule than red wines. Lastly, when a claret was distilled and the resulting weak spirit from it made up to the original volume of the claret and added to digestive agents there was practically no retarding effect. The distillate so tested was of the same alcoholic strength as the claret—i.e., 10 per cent.—and contained, of course, the volatile constituents of the wine, the colouring matters, &c., being left behind in the still. The actual result is shown in Table G. On the whole, therefore, we conclude that claret,

TABLE F.—*Digestion Experiments in Vitro.*

Description.	Pepsin. Percentage of albumin digested in 3 hours.	Pancreatin. Percentage of albumin digested in 3 hours.	Observations.
Leoville-Lascases. 1. St. Julien, 1890 ...	86·60	50·80	—
Rauzan Ségla. 2. Margaux, 1896... ...	84·00	—	—
Château Langoa. 3. St. Julien	80·00	54·00	—
Château d'Issan. 4. Cantenac, 1899 ...	81·00	—	—
Montrose St. Estèphe. 5. Médoc, 1899	79·40	—	—
Château Latour. 6. Pauillac, 1880	74·40	72·20	—
Château Haut Brion. 7. Graves Red, 1899 ...	71·00	—	—
Château Pavie. 8. Médoc, 1899	60·00	—	—
Château Dauzac. 9. Labarde, 1899	64·20	—	—
Château Lagune. 10. Ludon, 1890	66·20	—	—
Ducru Beaucaillou. 11. St. Julien, 1893 ...	78 00	—	—
Château Lafite. 12. Pauillac, 1896	69 00	—	—
Bevchevelle. 13. St. Julien, 1890 ...	—	47·00	—
Kirwan. 14. Cantenac	—	61·56	—
Château de Rayne. 15. Sauternes...	70·00	—	—
Petites Graves. 16. Vin Ordinaire... ...	80·00	—	—
Grand Sec. 17. 1er Vin de Graves ...	78·40	64·90	—
Vin Ordinaire. 18. Médoc...	80·00 (When decolourised 83·00)	82 05	Purchased in London.
Vin Ordinaire. 19. Médoc	77·80	—	,,
St. Vivien. 20. Bourgeois Wine ...	64·20	51·30	,,
Claret. 21. Bourgeois Wine ...	64·80	—	,,
Côtes. 22. Vin Ordinaire... ...	87·50	—	,,

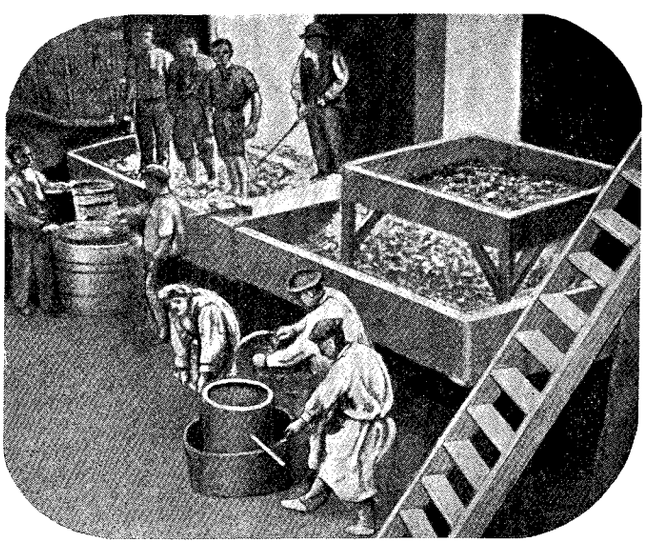
TABLE G.—*Digestion Experiments with Tannin, Grape Juice, and the Distillate of Claret.*

Description.	Pepsin. Percentage of albumin digested in 3 hours.	Pancreatin. Percentage of albumin digested in 3 hours.	Observations.
Tannin, 0·1 per cent. ...	92·00	—	—
Tannin, 0·2 per cent. ...	91·00	—	—
Grape juice (Médoc), pure	41·40	—	—
Grape juice, 20 per cent., ⅓ diluted	61·00	—	—
Distillate of claret = Brandy 10 per cent. alcohol	93·00	—	—
Water and pepsin + 1 gramme of albumin	95·00	—	—

when employed in moderate quantities, has very little, if any, retarding influence upon the chemical process of digestion and that when any effect is shown it is probably due in most cases to the colouring matter and in some cases it may possibly be owing to a high proportion of higher alcohols and ethers. The same remarks appear to apply to the few instances in which the effect of wines upon pancreatic digestion was tried. As already stated, however, these digestive experiments, while of undoubted relative interest, cannot be expected to throw much light on actual physiological conditions, especially as it is well known that wine has a decidedly stimulating action on the digestive functions.

Finally, in view of these recent experiments which we have made it is interesting to quote some of the statements from the report of THE LANCET Commission on the Medical Use of Wines, published in THE LANCET of July 24th, 1880, p. 146, especially as at that time analytical science was not so far advanced as it is now. "There are few conditions," it is therein written, "in which they (i.e. Bordeaux red wines) really disagree taken in ordinary quantities; their especal value consists in the fact that when taken with meals they are true tonics and have neither a stimulating nor a sedative effect. Even the higher priced red clarets are much less stimulating than the Sauternes and of course cannot be compared for a moment in this respect to either the red or the white Burgundies. The tonic effect of claret is due most probably to the peculiar combination of tannin with a certain but low percentage of alcohol, and it is remarkable how little variation in chemical composition exists between true red clarets although the price differs very greatly. The year of vintage, the age of the wine, the characteristics of the vineyard, by determining the bouquet and fragrance of the wine, enhance the price but interfere only very slightly indeed with its chief constituents as far as can be shown by chemical analysis. In cases of anæmia, ordinary debility from overwork, feeble digestion, &c., a sound red claret is almost as good a prescription as most of the tonic drugs in the Pharmacopœia and is always an advantageous adjunct to this class of remedies. Of course it must only be taken with meals and in no case should more than half a bottle be permitted with the meal. In this quantity the amount of alcohol is very small as may be seen by the analyses. In addition to the tonic properties of red claret its value in increasing the appetite and aiding digestion is of great importance. Many patients who can eat but little and so lose strength, especially in hot weather, improve very much if they take wine with their meals, and for this purpose claret is especially suitable. The percentage of grape sugar is very small indeed; it is much less than in ordinary Sauternes, or white clarets, although not so small as in the specimens of Chablis and Meursault to which we referred in our former article. Hence the diabetic patient may safely take an occasional wineglass of red claret, and there is this special advantage—that he need not be prohibited from the more expensive wine of this class, whereas Sauternes and white Burgundies of high class would inevitably increase his malady. Clarets are generally spoken of as 'sour' wines and avoided by the gouty and rheumatic but this is certainly a mistake. The amount of fixed acid is less than in most wines and the low percentage of alcohol is a still further advantage in such cases. In several cases of atonic gout a glass or two of good claret daily has been taken with great benefit although the patients may have been told that whisky, gin, and brandy were the only permissible forms in which they should take alcohol. In the treatment of persons with a tendency to obesity claret, as is well known, is particularly useful and it is doubtless also in part at least due to the absence of any amount of unfermented sugar. The amount of tannin sufficiently explains the slight astringent character of red wine and this is of great advantage in treating cases of atonic and so-called bilious dyspepsia and anæmia and patients with any tendency to relaxed or chronically congested mucous membranes. It is this astringency which clinically separates the thin red clarets from the thin white ones and renders them available for so many more forms of disease. Of course when diluted they are as grateful as refrigerants in cases of fever, and in hot weather as are the corresponding white varieties."

FIG. 4.



A typical Médoc press.

Again, "good sound red Bordeaux wines evidently differ very little in rough analysis and a patient may take either the cheaper or the more expensive varieties without running any risk of their having different medicinal effects, provided he is satisfied that he is dealing with a true claret. ..... The importance of this constancy in chemical composition is the more striking if we compare it with the great variability that is shown by the different typical samples of the white Bordeaux and white Burgundy wines which we have referred to in previous articles."

These interesting statements of THE LANCET Commission of a quarter of a century ago might have been written with equal force and truth in the light of recent inquiry. In the interval objectionable practices may have stepped in, but the conclusions of this Commission in 1880 are completely endorsed in 1905 by the conclusions of our Commissioner, who points out that, in spite of a certain amount of incredulity existing in the public mind, the statement published in an annotation a little over a year ago in THE LANCET to the effect that "Bordeaux wines or claret were never cheaper, more abundant, and purer than they are in the present day" is completely justified by his recent investigation of the sources of supply and by the analyses of the wines now actually offered to the public.