FURTHER REVELATIONS by C.Lovell.

INTRODUCTION.

Most of the information in this paper has not been easy to obtain, and much of it is sensitive. In most cases the sources of information have been indicated by a code; refer to the last sheet for the bibliography and codes. All statements have been made in good faith, but it is possible that some of the reference books are now out of date, or that legislation has changed. There may be mistakes, but then the man who makes no mistakes does not usually make anything: he certainly does not make attempts to find out the truth! The author will be glad to receive notice of corrections or any additional information.

THE MISSING PERCENTAGE.

Anyone who has read "The Truth about Flour" must wonder why the Trading Standards Inspectorate permits mills to remove a percentage of the ground wheat and yet still call the resulting product "Wholemeal". The regulations quite clearly state that Wholemeal flour should be "the whole of the product". Due to this curious lapse in enforcement it is now necessary to invent another word to describe wholemeal that has not had anything removed! Herein the term "real wholemeal" will be used. It should particularly be noted that the "1OO%" in "1OO% wholemeal" is not part of the legal definition, and in the light of the knowledge that often a percentage is missing, the 1OO% is positively misleading. It is quite clearly stated in several books that wholemeal as supplied to bakers has had about 5% of the total flour removed!

WHY the Inspectorate does not enforce the law remains a mystery. Why the millers indulge in this practice is a different matter; personal research has shown that in the smaller mills it is the result of a combination of lack of interest, lack of knowledge, and lack of conscience.

In the very small simple mills, the flour goes straight from the millstones into bags, but in larger mills it becomes necessary to store the flour in bins or hoppers; this means that the flour must be moved, usually in an upward direction. The most usual method of moving flour is by suction.

Installation of a suction system is very desirable to the millowner, as apart from moving the flour, it also keeps the millstones cool and prevents a build up of flour due to condensation, and hence greatly increases the output of the millstones. Suction systems are usually installed by contractors, and part of the "package" is a rotary screen on the end of the suction pipe; this consists of a rotating "screen" of wire mesh of such a size that the smaller pieces of flour pass through, but larger impurities are sent elsewhere. It is very easy for spiders and other things to get into flour. One of the most prevalent nuisances is the Flour Moth, against which millers fight a never−ending battle, so it is a great comfort to the miller if he can install a screen to remove any such things from his flour. This would be a legitimate and sensible use of screening because it would remove nothing from the flour that was not there in the first place, but as we shall see, the amount screened out when screens are used far exceeds the odd moth and spider. Incidentally, a common method of dealing with flour moths is to have a machine that chops them into pieces too small to be seen!

Sreening has another advantage; if the millstones are not set close enough, or are not sharp enough, then flour that is not as fine as desired can be separated by a screen. Thus a finer flour can be made by removing the larger pieces of bran, but if part of the whole is removed how can the resultant still be wholemeal?

It must be appreciated that not all millers are enthusiasts, or even want to be millers; for example, a farmer might start by milling animal feed and then try making some flour, find that he can sell it, and then expand that side of his business. A farm worker might then be given the job of running the mill − an indoor job unappealing to him. He would not have any great interest in milling, and not have read any books, or pay any attention to the niceties, such as getting exactly the correct fineness of flour. He would probably do little more than push buttons on a control panel. All the machinery would most likely have been installed by

contractors; the owner having given orders for this to be done, and left all the details to them. Almost certainly they would fit a screening machine as a matter of course, and might not even tell the owner about the possibility of removing or changing the size of the screen, and consequently something between 2% and 5% would be screened out. The screenings would be the larger particles of bran: they might be re−ground, or, more likely, packaged and sold as bran.

RECONSTITUTION.

All the above refers to the smaller mills. It is not easy to gain access to the very large mills, and their very size makes it impossible to understand exactly what is happening unless one is fully acquainted with the process and able to go where one wishes and stay there for a considerable time, but all large mills employ the gradual reduction process and are set up to produce white flour. The grain passes through rollers which tear it apart; it is then sieved and the larger particles are passed through rollers again, and then sieved again, and so on numerous times. This is a very simplified explanation but it will suffice here.

The germ and the bran are two items that are separated, and for many years they were sold as animal feed, but more recently they have been sold to health shops at a far greater price than they fetched as animal feed. When wheat is put through a modern gradual reduction mill a 1O0lb of wheat grain will produce about 70lb of flour, about 5lb of wheatgerm, and 15 to 2Olb of bran inextricably mixed with flour. The rest is lost in dust and evaporation.

If one of these large mills wishes to sell wholemeal flour without installing separate plant or a subsidiary mill, then the only way they can make it is to take the white flour before it is bleached, and then add back the wheatgerm and the bran in the same proportions as they were originally! One might call this "reconstituted wholemeal", and there would seem to be no reason why it should not be as good as real wholemeal. However, as the germ can be sold at a high price and amounts to only about 2%, and a blind eye is turned to a missing percentage.....? Furthermore, caramel is one of the few additives that can be legally added to wholemeal flour. Now the main purpose of adding caramel is to make the flour browner in colour, but the wheatgerm and bran makes the flour that colour anyhow, so unless something is missing there would seem no purpose in adding caramel − it is not a very desirable additive anyhow (see later). If millers can be persuaded to talk they can reveal instances where the re−constitution has been only partial and there have been complaints when it has been discovered.....of course it has always happened at some mill other than their own. Heat is generated when flour is ground, and some of the moisture in the grain is lost in evaporation. It follows therefore that 100lb of wheat will not produce EXACTLY 1OOlb of flour, but this slight loss is quite a different matter to that caused by deliberate screening or only partial reconstitution.

ROLLER GROUND OR STONEGROUND?

The term used by millers for turning grain into flour or meal is "reduction".There are three basic methods of reduction:

1. Grinding − between stones or any abrasive surface.
2. Attrition − by hitting the wheat with revolving metal "hammers".
3. Rolling − tearing the grains apart.

There is nothing intrinsically "better" about flour produced by one method than another, but remember that the rollers are part of the gradual reduction process which has just been considered, and their wholemeal is therefore reconstituted.

One sometimes reads about roller mills producing excessive heat in the flour and that this is somehow detrimental to it. Perhaps this was true in the very early days of roller milling, but it is unlikely to be true now because the whole purpose of the gradual reduction process is to be gradual. However, sometimes there are

mistakes and the rollers are set too close together or the grain is fed in too fast. The starch quality is then destroyed. If a loaf is made with such a flour and is turned out of a tin it will be found to have almost razor−sharp corners.

There is one curious theory which states that flour ground on a stonemill which is enclosed in wood is "better" than flour which has touched metal and been electrically earthed.

WHITE, BROWN, AND WHOLEMEAL.

Brown flour legally has to have at least O.6% crude fibre in it, and this is contained in the bran, but legally no wheatgerm has to be present. Here again we come up against what might be called "real brown" and "brown". As we have seen, if brown flour is made by the gradual reduction process the wheatgerm will not be present because it has been taken out and there is no legal obligation to return it; therefore most "brown" flour has caramel added to it to colour it. However, if the flour is produced in a small mill that does not use the gradual reduction process, it would be wholemeal with some of the bran removed but still with most of the germ still in it − "real" brown flour.

White flour is bleached white (see later), but in some shops it is possible to purchase unbleached white flour, and the packet will then be marked "unbleached". Herein, whenever white flour is mentioned it must be understood that the reference is to bleached flour. White flour, whether bleached or not, has much taken out of it. The following list shows percentage losses over wholemeal. Taken from Issue No 24. May 1971 of the American Journal of Clinical Nutrition (H. Schroeder).

Thiamine (Vit B1)	77.1%
Riboflavine (Vit B2)	8O.O%
Niacin	8O.8%
Vitamin B6	71.8%
Pantothenic Acid	5O.O%
Alpha−Tocopherol (vit E)	86.3%
Calcium	6O.O%
Phosphorous	7O.9%
Magnesium	84.7%
Potassium	77.O%
Sodium	78.3%
Chromium	4O.O%
Manganese	85.8%
Iron	75.6%
Cobalt	88.5%
Copper	67.9%
Zinc	77.7%
Selenium	15.9%
Molybdenum	48.0%

CHEMICAL REVELATIONS.

Now that chemicals are being considered, and before any more mention is made of them, it is necessary to understand something about the Science of Chemistry. Do not worry. There are not going to be pages of chemical formulae!

Many people − probably MOST people, have no knowledge of chemistry, and their concept of it is limited to that gained by visiting the local chemist's shop and perhaps seeing a white−coated compounder in the distance. This mysterious person can sometimes be seen handling clearly labelled jars and bottles and mixing their contents together in minute amounts. Obviously everything is precise and correct, and accurate. However, the SCIENCE of chemistry is not like that at all!

Like other sciences, new discoveries and new knowledge is being gained almost daily; old ideas and concepts are superseded as more information is acquired. Because chemistry is a continually developing science, new discoveries are frequently made that render names obsolete. For example; Vitamin Bx is the obsolete name for para−amino benzoic acid. These changes in nomenclature make it very difficult for the interested but chemically−ignorant layman to understand written information. Sometimes there are 3 or 4 different names used to describe the same thing, and of course, the older books use the older names. Unfortunately some of the newer books also persist in using the old names! Further confusion is caused by the use of "blanket" names, for example; Nitrogen, which is, of course, a gas, but in nutrition all nitrogen−containing substances are loosely referred to as "nitrogen".(DNFT p154)

Also there are no International standards of analysis − or even National ones. For example, there are three methods of calculating the calorific content of food. (C.O.F. P177). There are further differences between methods used in the U.K. and the U.S.A. Whereas the results obtained by the three methods of calculating the calorific content only differ from each other by a small amount, when it comes to measuring the FIBRE content of bran there is an enormous difference between the two methods currently used in analysis. In fact the analysts cannot even agree on the name of the product for which they are searching! By the most accurate method it is found that wholemeal flour has about 9.6 grams of DIETARY fibre per 1OO grams. By the "official" method as used by public analyst, and as defined in the Regulations, wholemeal has only 2.2 grams of CRUDE fibre per 1OO grams. The "official" method is much quicker, but underestimates most of the different components.

This confusing state is not helped when mistakes are made by those whom one would expect to know better. When a new factor was discovered that was claimed to be essential for chick growth, the claimant stated that as nine factors of the B vitamin were already known the new factors should be called vitamins B1O and B11. In fact the B vitamins had been numbered only up to B6; and B7, B8 and B9 had never existed! (DNFT p232)

It obviously follows from the above that the confusion becomes greater when one considers all these matters on an International basis. Although there are International agreements on nomenclature, these are not always followed. An example is Nicotinic Acid,− which is sometimes still called by its old name of Vitamin PP (pellagra−preventative); Nicotinic acid's amide, nicotinamide, has the same biological function, and both are known according to International agreement as Niacin. However in the U.S.A. the old designations Niacin and Niacinamide for Nicotinic acid and it's amide are still used. (DNFT P121).

There always seems to be someone to contradict someone else! A note at the commencement of that great work of reference, "The Composition of Foods" acknowledges this state of affairs by stating that advice and help were received from many sources − much of it contradictory.

After this explanation the reader must think Chemistry is all very confusing, but this is as nothing to the confusion we shall find further on! However, we shall try to make sense out of chaos, and this is a good place to learn about the system of E numbers which has been devised to make things simpler.....and we know by now what that means!

E.NUMBERS.

Additives that have been agreed by the EEC as safe have been given E numbers, and these can then be used for labelling and other purposes instead of listing out the chemicals with their full names. The fact that some

chemicals have E numbers does not mean that ONLY the additives which have been given a number may be used: there are many additives used − different ones by different countries − that do not have E numbers.

The list is constantly under review. Other additives have numbers, which are contained in square brackets; these are additives that the EEC are examining to see if they might qualify for an E number (sometimes the square brackets are omitted!); Caramel is one of these, yet it is commonly used in flour. Incidentally caramel is also one of those items deemed to upset hyperactive children, as is also E220 which is in common use. Confused? Read on. There are some E numbers in use that have not been accepted by other countries.....including Britain. (EN p4)

The E system is a good and much needed idea, but has proved impractical in its application in its present form.

All food made after 1 Jan 1986 must bear the E number or the actual name of the additives. Words such as "permitted colouring" are illegal. However, the words "permitted flavouring" is still be allowed..... no one is likely to use the words "unpermitted flavouring"! There are no regulations agreed by the E.E.C. regarding the composition of flavours, although five are banned in the U.K. (EN)

COMPULSORY ADDITIVES.

There are certain compulsory additives that must be legally added to "enrich" flour in

Britain. The impression given is that this is some wonderful gesture by the Government to give us better flour..... but more revelations now.

There are four things that must be compulsorily added to all flour other than wholemeal; collectively they are called "nutrients".

CALCIUM. (Creta preparata).

It was decided that Calcium ("Chalk") should be added to British wartime bread after an outbreak of rickets in Dublin in 194O. At that time it was thought that a drop in calcium intake caused by the rationing of normal calcium−rich foods such as milk and cheese would cause more children to develop rickets, and some adults to develop the bone disease, osteomalacia. Since then it has been found that vitamin D deficiency is more likely to be the major cause of these two diseases. Dr Widdowson, whose research played an influential role in the wartime enrichment policy, summed up the situation thus:− "When Calcium was added to flour originally, there were reasons for doing so, but these reasons have now gone". (TACC p34). Nevertheless it is still compulsory for Calcium to be added to all flour other than wholemeal. The amount that must be added is so great (see overleaf) that there is LESS Calcium in Wholemeal flour than in other flours. On the other hand, Calcium propionate, which is a commonly used (non−compulsory) additive, destroys the enzymes that enables the body to utilise the calcium in white bread. Back to square one!

IRON.

Iron is added in the belief that the incidence of anaemia due to iron deficiency will be reduced. However, recent research has shown that not only is this useless as a means of reducing anaemia but it is potentially harmful (SWEB p4). Moreover bread enrichment with iron normally takes the form of metallic iron in powdered or reduced states. Neither form is well absorbed by humans; if the body could use inorganic iron, then drinking water containing iron rust from a rusty pipe should help build red blood cells in anaemic conditions, but we know that this is not so (SWEB p3). As a matter of interest, the amount of iron in a human body is less than that in a small nail.(TACC p3)

THIAMIN. (Vitamin B1).

Although Thiamin must be added, about half of it is destroyed by the baking process because synthetic thiamine is heat sensitive! (TACC p4)

NICOTINIC ACID OR NICOTINAMIDE. (Vitamin B2).

This is another synthetic vitamin, and these SYNTHETIC vitamins cannot be used by the body as natural vitamins are used. Synthetic vitamins are coal tar products, and some coal tar products are suspected of being cancer producing (SWEB P3). However, as so often, there is a contrary opinion that states, "there is no difference between the physiological affects of a synthetic and a naturally occurring vitamin, they are biologically and chemically identical". (MCC p428)

It must be obvious to the reader by now that logic has little bearing either to the matter under consideration or, regrettably, to anything that follows! However, so conditioned are we to logic that one assumes that if certain items are extracted from flour, and if it is considered necessary to put some of these back, then surely as much would be put back as was taken out. Oh no! The following table clearly shows that the quantity of each additive is only about half the quantity naturally found in wholemeal flour; except in the case of Calcium which, as we have just seen, has its own special illogicality! (COF p38)

Milligrams per 100 grams.

Additive.	Amount to be added.	Amount in wholemeal.
Iron	1.65(min)	4.O
Thiamin(B1)	O.24(min)	O.46
Nicotinic Acid (B2)or Nicotinamide	1.6O(min)	5.6
Calcium	235(min) − 390(Max)	5.0

So the "enrichment" (another word used is "fortification") of flour certainly does not anywhere near bring it up to the standard of wholemeal. Over twenty vitamin and mineral elements are greatly reduced when wheat is turned into white flour, only three or four are added back, and only in small amounts. Moreover what is added back is either synthetic or inorganic, and is considered by some to be positively harmful though.

If this is indeed the true situation then why must these additives be put into non−wholemeal flour? "The whole history of the 'enrichment' program shows abject subservience of government nutritionists to the pressure of big business".(SWEB P6). On 18th July 194O Mr (later Lord) Boothby stated that the Ministry of Food proposed to add synthetic vitamin B1 to bread. This was most curious: Governments had often legislated about bread, but never before with the ostensible object of enriching it. Mr Boothby went on to say "Many Hon. Members know that.....I was chairman of a company which manufactured these vitamins. I.....resigned my seat on the board immediately I was appointed Parliamentary Secretary".(ODB P17). However, he did not go on to say that he had renounced a directorship or disposed of his shares!

The scientists seem to form two camps, the "extract and then add" group, and the "keep the flour whole" side. In the E.E.C. only Denmark, apart from the U.K., makes enrichment with nutrients compulsory. In fact, most west European countries forbid the replacement of nutrients. (TACC p78).

There are many other additives that are not compulsory but that are optionally permitted; but before these are considered it is necessary to learn something about the baking industry.

THE BAKING INDUSTRY.

Although, of course, some small and medium sized bakeries still exist, most of to−day's bread is produced in large bread factories. Few people have any idea of the process involved, so here we will take a look at the subject, and gain an insight into why the mass−produced bread is so tasteless.

For centuries bread has been made by fermentation, which has taken something between five and twenty−four hours. It is not generally known that during this time there also occurs a modification in the gluten structure of the dough which makes it capable of stretching. This is known as DOUGH DEVELOPMENT.

It is only in the last sixty years or so that the availability of fresh yeast has enabled the fermenting time to be greatly reduced. Since then, various attempts have been made to bring about the rapid DEVELOPMENT of the dough by mechanical means. For many years the large bakers' dream has been a machine which would spew forth a continuous stream of dough which would then be entirely automatically baked, sliced and wrapped. Such a machine did indeed become available − the Oakes Continuous Mixer. The dream was thus fulfilled, but in actual practice it has been found that in many cases it is more suitable to have a system that produces "batches" of dough in rapid succession than one continuous stream. The batch system enables the dough mix to be changed more easily than in a continuous system, and also enables the process to be stopped should any of the succeeding stages develop a mechanical fault. One can imagine the chaos if a continuous stream of dough is issuing whilst the rest of the production line is out of action! Moreover a batch system can be varied in size to suit smaller bakers and those who are not able to afford the enormous cost of a continuous system.

Research on mechanical dough development had taken place, rather spasmodically, over several decades, but no satisfactory commercial progress was made until the British Baking Industries Research Association at Chorley Wood really made a serious concerted attempt at solving the matter, and finally succeeded. It was at the London Bakery Exhibition of 1963 that the Chorley Wood Bread Process was accepted by the baking industry, and the large bread factories as we now know them came into being. By 1972 80% of British Bread was made by the Chorley Wood Bread Process. Known as CBP.

The CBP consists of very high speed mixing combined with meticulously accurate timing. The ingredients themselves must also be meticulously accurate in their chemical consistency and quantity. Some idea of the care needed can be gained from the fact that the timing of the mixing process must be accurate to within about two seconds. Other requirements are a specified level of an oxidising agent; a critical minimum level of a correctly constituted fat; and a partial vacuum in the mixer. The mixer is run for only about 3 minutes, and because the dough development cycle is so very short the rate of water absorption by the flour must be precise and vary as little as possible. The chemical composition of the flour in other respects must also be precisely correct, and this why "any old flour" plays havoc with C.B.P. systems.

The advantages of the C.B.P. are that the conventional mixing and bulk fermentation stage is replaced by a short period of intensive mixing. The mixing only lasts about 3 minutes as compared with the conventional 20 minutes. After mixing, the dough can be immediately divided instead of being left to stand and ferment, and a great amount of floor area is thereby saved. Another great advantage is that the dough can absorb more water, and water is cheaper than flour. The conventional system uses about 14 to 16 gallons of water to every 280lb of flour; the C.B.P. uses 17 to 18 gallons of water to the same amount of flour; so from 60% to 63% of the mix is water.(BMR p99). This is higher than the permitted limit in the U.S.A. or Australia. In Britain there is no legislation covering the water content of bread, so there is no need to reveal it to the customer. (EYB p126). The operators of the C.B.P. do not consider excessive water detrimental to the quality of the bread (well, they wouldn't would they?), but luckily for the customer the use of too much water causes stick−ups on the plant. (BMR p171).

A further advantage of the C.B.P. is that as there is no bulk fermentation less flour solids are lost in the form of gas and alcohol. (MCC p26).

Another advantage to the baker is that the C.B.P. enables the percentage of strong, and hence expensive, wheat to be reduced. This has become an important factor now that the E.E.C. agricultural policy has put severe economic pressure on British millers to use E.E.C. wheat. (BMR p99).

A great deal of research went into perfecting the C.B.P.; not only had the machines to be designed, but suitable oxidants and new yeasts had to be discovered because the C.B.P. imposes conditions upon yeast which are quite different to that obtaining in the normal 3−4 hour bulk fermentation process. (BMR p103)

From the above brief description one can appreciate that the new process meant that bakers had to become FAR more accurate in their measurements, and much more consistent with the chemical constitution of their ingredients. Also they had to have reliable automatic controls for the whole process, for with batches becoming ready at approximately 5 minute intervals (depending upon the size of the mixer installed) it is essential that all the subsequent stages be precisely timed. This is necessary not only for producing an acceptable loaf, but to keep all stages of what has now become a production line in step with one another.

The sequence of events in a full scale C.B.P. is:−Mix (2 − 3 mins).Divide the dough (and check weigh some pieces).Pass dough through a Conical Moulder. This gives individual dough pieces some semblance of crumb direction, and helps put them into a shape that can be easily handled by the final moulder. Put dough into first prover for 6 to 8 minutes − previously this used to take about 20 minutes. Pass dough through final moulder where the finished texture and cell formation of the loaf are created, and the dough is placed in tins. The Final proof takes between 45 and 59 minutes. Baking takes place in a continuous oven, the bread moving slowly through it for 26 to 40 minutes. Automatic de−panning then occurs. Cooling has to follow the baking, and this normally takes at least two hours and forty minutes. The final stage is slicing and wrapping.

The simple bakery has thus become an enormously costly production line − there are many other things to be synchronised that have not been mentioned above. Smaller bakers do not need to install the complete system, they can purchase the high−speed mixer in a range of sizes from one to mix only ten pounds of ingredients to the large machines which mix 660lbs in a few minutes. With the smaller mixers it is possible to use less sophisticated ancillary machinery; this enables smaller bakers to change from the traditional methods to the CBP, the high cost of the machinery being offset by the saving in time, space, and the increased amount of water that can be used. Bakeries that use the CBP are usually called "plant" bakeries.

About 70% of bread in Britain is made by the very large bakeries. The remaining 30% is produced by about 100 large−scale plant bakeries and some 6000 (non−plant) "master bakers" − this rather grandiose title merely means that they employ less than eight people! (TACC p54)

It is now possible to begin to appreciate why the white sliced, wrapped loaf has been described as "cotton wool" and "plastic" bread. It is established beyond doubt that the high rate and level of work input of the C.B.P. profoundly effects the wheat gluten network when compared with a dough mixed on a conventional machine. (BMR p69) It would not be inaccurate to state that the actual chemical composition is altered. Various chemicals are also added to a flour which has not only been bleached but has lost all its germ and most of its bran. Moreover, the bread has a higher water content and a lower protein content (due to the use of weaker wheat) than "old−fashioned" bread.

In spite of the enormous amount of research into bread and flour, there are some things that the chemists have been quite unable to solve. There are some flours that give satisfactory bread from a recipe containing no added fats. Similarly there are flours which seem to require excessively high levels of fat to obtain satisfactory bread, and even then the optimum loaf is of poor quality. None of the usual chemical or physical tests seem to pick out any difference between these flours and normal flour, nor are these flours from any

particular wheat variety. (BMR p64).

PERMITTED ADDITIVES.

We have already considered the so−called "enrichment" of flour by compulsory additives, so the reader should not be at all surprised to learn that some of the permitted additives are called "improvers".

IMPROVERS.

When freshly milled flour (other than wholemeal) (MBR p174) is stored for several weeks it undergoes an aging effect and produces a stronger and more resilient dough and a bolder loaf: it "improves", and slowly bleaches. Chemical agents can produce these effects instantly. Some will only bleach, some will bleach and improve, and yet others will only improve.(DNFT p9)

BLEACHING.

However many times flour is sieved and rolled in the large mills it is still not white enough for the marketing men, so it is bleached to produce "whiter than white" flour. Various chemicals have been used over the years for bleaching flour. Whenever the safety of these chemicals was queried many eminent scientists stated that they were not dangerous, yet nevertheless, they have been made illegal by the committes appointed to enquire into the matter. An outstanding law case concerned the bleaching of flour by means of traces of Nitrogen Peroxide. The court learned from a parade of 'experts' that there was no deleterious action to the flour, and that rainwater contained 7O times the quantity that was in bleached flour, that Ham contained 5OO times that amount, and that even human saliva contained 13 times as much. In spite of this evidence, Nitrogen Peroxide is now no longer used for bleaching!

Perhaps even more curious is the case of Nitrogen Trichloride, commonly called Agene, that was used as a bleaching agent for many years, the Committee investigating its use once again indulged in double−talk. "The Committee has been unable to find any evidence that agenised flour is in any way toxic to man. Nevertheless.....the Committee feel that the use of Agene should be discontinued"! (MCC p108).

One cannot but wonder whether those listening to the scientists knew in their hearts that the information that they were being given was not accurate. It is obvious that much goes on behind the scenes, and the only conclusion that a layman can draw is that it is never wise to believe any statement about additives being harmless.

As long ago as 1927 the Departmental Committee on the Treatment of Flour with Chemical Substances gave a warning against the use of Chlorine Dioxide. (RSH Vol5 1957). The Bread Flour Regulations 196O confirmed this view by reccomending that only one bleaching agent be used − Benzoyl Peroxide (at no more than 5Oppm), which is a powder. Behind−the−scenes intrigue and duplicity continues, for in spite of these recomendations, the 1984 Regulations also permit the use of Chlorine and Chlorine dioxide, which is a gas.

It is not the intention to delve deeply into chemistry, so the permitted additives have been listed under different functional headings although many chemicals perform more than one function. Not all additives are permitted in ALL types of flour and bread, many are restricted to specific uses, for example Rye bread, or soda bread only. Some may not be used in conjunction with others. Many of them have restrictions on the quantity that may be used. For more information see The Bread and Flour Regulations 1984. All these additives are expensive and have their specific uses which can radically affect the finished product, so there is no point in the baker adding more than the necessary amount.

There is little purpose in giving the full list of additives under their broad headings until one knows what these headings mean; so now the headings are considered one by one, and finally the full list is given.

BLEACHES IMPROVERS.

Improving does not refer to improving the taste or improving the nutritional quality of the flour, but to improving its behaviour when made into dough by machines. Ascorbic Acid (vitamin C) is the only improver permitted by all the original common market countries with the exception of Holland, where five bleachers and improvers are allowed. With our 8 or so (depending how they are classified), improvers and bleaching chemicals we are still well ahead − or behind.(EYB p57) Benzoyl peroxide, which is a commonly used bleach, is often given the more innocent−sounding title of a "colour control" (UDB p137), and it only bleaches, whereas Chlorine dioxide bleaches and also improves, and Potassium bromate is an improver, but does not bleach.

Although improvers had been used optionally by bakers for some years, they are as an essential an ingredient of the C.B.P. as oxidants. They also stabilise the gas cells so that they can withstand the pressures generated during proving and baking. The detailed chemical reaction caused by the addition of improvers is a highly complex subject.

OXIDANTS.

These produce a stable, stronger, more elastic gluten network capable of expanding without rupture. They are listed under Improvers. Vital for CBP.

EMULSIFIERS EMULSIFYING SALTS.

These help to bring together oil(fat) and water so that they do not separate out into layers as they would do without emulsifiers.

RAISING AGENTS.

Self−raising flour contains ingredients that generate Carbon Dioxide when mixed into a dough and baked. Since there is no yeast fermentation, nor usually much time involved, there is neither ripening of the dough nor mellowing of the gluten; the characteristics of flour used for self−raising flour are therefore different from that of normal (plain) flour.(MCC p368).

BULKING AGENTS

These are used in bread for which a slimming claim is made, they "pad out" without adding to the calorific or energy value of food.

YEAST FOODS

There is not enough sugar in flour for yeast to feed upon, so more must be added in one form or another.

ROPE INHIBITORS

Rope is a micro−organism named Baccillus mesentericus, and is present in all bakery materials to some extent. Rope spores are very common and widely distributed in soil. They can survive the baking process, and can start to grow when temperature has returned to the ambient one. Modern hygiene and increased scientific knowledge has resulted in spore counts being a fraction of those which prevailed 25 years ago; it is only when conditions are particularly suitable for the rapid multiplication of rope spores that an infestation is likely to occur; for example, holding the bread at a high temperature in a humid atmosphere whilst it is being slowly cooled.(UDB p10). In extreme instances, almost the whole of the middle of an infected loaf may

become a sticky semi−fluid mass of a brownish colour with an unpleasant smell. If the crumb is then touched with any article it can be pulled out in long threads or "ropes". (MCC p533).

MOULD INHIBITORS

There are a vast number of moulds that grow on bread; they are of many colours, black, white, green, pink, or brown. Modern hygiene has reduced their infestation. A rare, but nevertheless interesting form of contamination, is due to Erythrobacillus prodigiosus. Certain virulent but rare strains are capable of turning bread blood red in about 24 hours. The bread thus infected is called "bleeding bread".

Calcium propionate is a commonly used mould inhibitor, but it also destroys the enzyme that enables the body to utilize the Calcium in white bread (SWEB p5)

PRESERVATIVES.

Although mould and rope inhibitors are also, of course, preservatives, others are also added.

BUFFERS.

Buffers are chemical substances which can resist considerable changes in the acid/alkali balance of solutions: the scale along which these are measured is called the pH. Buffers maintain the pH at a predetermined level despite the addition of further acid or alkali.

DIASTATIC ENZYMES (Amylases).

An enzyme is a biological material which helps a chemical change take place, but which remains unchanged at the end of the reaction. (BMR p107) Starch consists of many sugar units joined together in chains; it is naturally present in grain in order to provide a food supply for the growing plant during germination, and is broken down to sugar for this purpose by the diastatic group of enzymes which are called Amylases.

There are in fact two kinds of Amylase − alpha and beta. There is always adequate beta−amylase, but the alpha−amylase may be insufficient to produce enough sugar. The amount of alpha−amylase present in untreated flour depends on the extent of germination of the wheat during harvesting. (UDB p29).

Australian wheat, and also some American and Russian, is liable to have a shortage of cereal amylase; however, more and more E.E.C. wheat is now used in Britain, and this has rather an EXCESS of cereal amylase − there are no chemicals yet available to counteract this.

PROTEINASES.

Proteinase is the old name for Endo−peptidases (DONF p181) but as many books have the old name it is as well to keep to it here.

There are enzymes present in flour that are capable of attacking proteins though they themselves are also proteins; they are referred to as Proteases. There are two types, Proteinases that hydrolise true proteins, and peptidases that act on protein decomposition products.(MCC p280) Proteases have a mellowing effect on dough.

SODA BREAD.

Yeast not only produces gas for the aerating of dough, it also plays a part in dough ripeness. Baking powder, when used in conjunction with an acid, also produces gas but it has no such ripening powers. In Ireland, which has a very wet climate and where mainly soft wheat is grown, much of the bread is aerated by means of baking powder (baking soda), and is known as soda bread. Technically this is called "chemically aerated bread".

CRUMB SOFTENERS.

Crumb softeners are also emulsifiers, and assist in retarding crumb firming by inhibiting the release of water from soluble starch. The benefits of using them are: Increased volume of bread; A moister softer crumb; a finer, whiter crumb. (UDB p71)

THE LIST OF PERMITTED ADDITIVES.

The letters F and B after a chemical indicate whether it is permitted in flour or in bread. Many of these chemicals may be purchased ready−compounded and under proprietary names, for example "Ambirex" consists of yeast foods, oxidant, fat, and soya flour in correct proportions. The formulae are kept secret by the manufacturers, and bakers buy them on the strength of their known performance, not on their (often unknown) chemical constituents.

COLOUR.

E150. Caramel (F

CHALK.

E170. Calcium Carbonate (F

BLEACH.

Benzoyl peroxide (F

IMPROVERS.

E220. Sulphur Dioxide (F)

E300. l−Ascorbic Acid (F

E920. l−Cysteine hydrochloride (F

E924. Potassium bromate (F

IMPROVER.(Fast acting)

E927. Azodicarbonamide (F

IMPROVERS BLEACHERS.

E925. Chlorine (F)

E926. Chlorine dioxide (F

PRESERVATIVES.

E223. Sodium Metabisulphate (F

E290. Carbon Dioxide (B)

E270. Lactic Acid (B)

ROPE INHIBITORS.

E260. Acetic Acid (B)

E262. Sodium Hydrogen diacetate (B)

MOULD INHIBITORS.

E280.	Propionic Acid (B)
E281.	Sodium propionate (B)
E282.	Calcium propionate (B)
E283.	Potassium propionate (B)
PRESERVATIVE BUFFER (Rye).	
E330.	Citric Acid (B)
E333.	tri−Calcium citrate. (B)
EMULSIFYING SALT.(Rye)	
E333.	triCalcium citrate (B)
RAISING AGENTS.(For self−raising flour).	
E336.	mono−Potassium l−(+)−tartrate (Cream of Tartar). (F
E341(a).	Calcium tetrahydrogen diorthosphosphate (B)
RAISING AGENT EMULSIFIER.	
E450.	diSodium dihydrogen diphosphate (F
BULKING AGENTS. (For bread for which a slimming claim is made).	
E460.	alpha−Cellulose (B)
E466.	Carboxymethylcellulose sodium salt (B)
EMULSIFIERS.	
E471.	Mono− and diglycerides of fatty acids (B)
E472(a).	Lactic acid esters of mono− and diglycerides of fattyacids (B)
E472(c).	Citric acid esters of mono− and diglycerides of fatty acids (B)
E472(e).	Mono− and diacetyltartaric acid esters of mono− and diglycerides of fatty acids (B)
E481.	Sodium stearoyl−2−lactylate (B)
E482.	Calcium stearoyl−2−lactylate (B)
EMULSIFIER YEAST FOOD etc.	
E341(c).	tri−Calcium diorthophosphate (F
CRUMB SOFTENERS EMULSIFIERS.	
E322.	Lecithins (B)
E483.	Stearyl tartrate (B)
RAISING AGENTS FOR SODA BREAD.	
E500.	Sodium hydrogen carbonate (Baking Soda)(F
E575.	d−Glucono−1,5−lactone (Acid)(F
E541.	Sodium aluminium phosphate, acidic (F

YEAST FOODS.

E510.	Ammonium chloride (B)
E516.	Calcium suplhate (Fsulphate (B)

AERATOR. (for aerated bread).

Nitrogen (B)

DIASTATIC ENZYMES.

Alpha−amylase.(F)

BUFFERS.

Ammonium hydrogen orthophosphate (B)

Ammonium dihydrogen orthophosphate (B)

PROTEINASES.

It is not possible to consider all these items individually − there would be page after page of contrary opinions!

OTHER ADDITIVES.

A number of less "chemical" additives may also be added to bread and flour, some are limited as to the amount that may be added.:Milk and egg products.Liquid or dried egg.Rice Flour.Cracked oat grain, oatmeal, oat flakes.Soya bean flourSalt.Vinegar.Oils and fats.Malt extract.Malt flour.Any soluble carbohydrate sweetening matter.Prepared wheat Gluten.Poppy seeds, sesame seeds, caraway seeds.Cracked wheat, cracked or kibbled malted wheat, flaked malted wheat, kibbled malted Rye. Cracked or kibbled malted barley.Starch other than modified starch (high amylose starch).

SOYA BEAN OIL.

Soya bean oil includes approx' 4% of the natural emulsifier Lecithin. The protein and oil fractions plus lecithin combine to improve the quality of the crumb of the baked loaf, giving it an increased softness and resilience − a soft but not soggy feel when compressed by hand. (BMR p108)

SAFFRON.

Saffron is composed of dried stigmas of cultivated crocuses; they add colour and flavour. (UDB p72)

CARAWAY.

This is strictly not a seed but a fruit.

MALT.

Malt can only be used successfully with care and understanding. It can be a bread improver only when it is necessary to make up a diastatic deficiency in flour. The exception, of course, is malt bread when it is an essential ingredient. (UDB p66)

All the additives that have been mentioned are listed in the Bread and Food Regulations 1984. It is interesting to note that the Regulations do not apply to a certain part of the population − Her Majesty's forces or visiting

forces. There is no explanation given for this.

Deliberately no attempt has been made herein to come to a conclusion as to whether additives are "good" or "bad". It is perfectly easy to produce quotes from scientific sources in favour of both viewpoints. Once one starts to examine the additives in detail one becomes bogged down (and this is a good metaphor) by the subdivision of that chemical into smaller and smaller components, and by contrary viewpoints on every single item.

ORGANIC

Organic foods are those grown with the minimum of artificial fertilisers and chemical sprays. However, there is no Standard or Regulation affecting the use of the word "organic". Scientists are not in agreement over how long it takes soil to become organic if it has previously been been chemicalised − some say five years, others say twenty years.

Grain is usually treated with chemicals before being sown, but whether this is so for organic crops is only known to the farmer.The natural manures used instead of chemical fertilisers may have come from cattle that have been injected with chemicals. Some of the organic wheat is grown in fields adjacent to fields which do not have organic crops and which might be sprayed from the air. There is always the risk of drifting spray.

A statement is usually made on the packet when it contains flour milled from organic wheat. Sometimes the organic wheat has been mixed with imported hard wheat that is not organic. Often no mention of this will appear on the packet.(EBYC p51).

If buying organic flour one can only hope that everyone concerned with its production has been honest and conscientious. Those of you who have read this far will realise that such people are few and far between.

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