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Bacterial Fermentation and the Missing Terroir Factor in Historic Cookery

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Although much credit has been given lately in gastronomic writing to the role of *terroir*, the power of food products to express unique traits reflecting geological, environmental and human factors of production, recognition of bacteria in these processes has been less apparent. Bacteria in the modern consciousness are pathogenic germs to be eradicated from kitchen surfaces, equipment and hands. With the triumph of modern scientific production methods, fermented products such as cheese, cured meats, pickles, bread and wine, have suffered from association with potentially harmful bacteria. In the name of food safety, predictability and product consistency these foods are routinely sterilized and are then inoculated with laboratory-tested, carefully controlled strains of micro-organisms. The unique properties of local bacterial populations are thus obliterated through such seemingly benign processes as pasteurization, or crowded out with super quick-acting starter cultures. The result is bland homogenous food catering to the lowest common gastronomic denominator. Flavorless, characterless, sterile products no longer reflect place but the demands of the industrial marketplace which require long distance shipping, stable shelf-life and, most importantly, uniformity and consistency.

This paper records the practical results of producing fermented products without modern methods or equipment in an effort to reconstruct the historical profile of local bacteria during the course of one year, from fall, 2008 to fall, 2009 at 38 degrees North latitude and 121 degrees West longitude, at Stockton California, located in the Central Valley, a flat arid plain with a Mediterranean climate. Without the use of modern equipment, commercial bacterial strains or the advice of modern do-it-yourself guides, this paper recounts the results of crafting three traditionally hand-made products: sourdough bread, aged cheese and dry salami.

The thesis of this project is simple. When we speak of local flavors and the immense variety of traditionally made fermented products from place to place, we are largely speaking of local bacteria: lactobacilli, streptococci, leuconostoc and dozens of other micro-organisms, molds and fungi that create an entire biological complex that is directly responsible for shaping the flavor-profile of traditional fermented products. The names of these organisms are less important than the crucial role they play through history in giving specific places unique flavors and also in explaining why certain products can only be produced with specific environmental conditions with the right microbiota. This project is intended to suggest modes of research which will initiate a new phase in historical food research. The aim is to reconstruct not only recipes

as described in old cookbooks, but the unrecorded methods handed down orally or discovered through trial and error which give us an approximation of the flavors our forebears enjoyed in both the distant and recent past.

Predictably, historic methods developed in Europe, or anywhere on earth for that matter, should not be possible to replicate elsewhere since the local flora differ greatly. But it is precisely in this difference that I intend to support my general thesis. Even given comparable climate, soil, and production methods and all other factors that are believed to constitute '*terroir*', it is the bacteria which are the crucial factor in determining taste. Industrial products can be replicated anywhere, but given the vagaries of bacteria residing on human hands, in the air and on equipment, it will be argued that this is the missing factor in that determines the taste of place.

Let me assert from the outset that the approach here is decidedly unscientific. There was no attempt to isolate and identify specific bacterial strains, no systematic testing of the different microbes in isolation to judge what role they may have played in creating flavor, texture, consistency, etc. I leave this to laboratory science. Rather the intent was to replicate traditional uncontrolled food techniques to show how place does make a difference and how it is precisely the interaction of dozens of microbes in tandem, forming an ecosystem unique to every place and every individual set of hands that ultimately shapes what we think of as *terroir*.

Bread

I will begin with one of the most basic of natural ferments: bread. Contrary to all dictated wisdom in modern baking guides, creation of natural leavening is spontaneous and requires little human intervention. Thrice daily feedings of the starter, temperature and humidity controls, all the factors that commercial bakers, even the best, monitor for consistency would not have been possible in the past. Thus I began with a simple combination of flour and water. Bacteria were present on the flour to start with, on the bowl, in the air, on my hands. Simply feeding a moist slurry of flour and water daily allowed these to thrive and after two weeks it was strong enough to raise bread dough. Unlike baking with commercial yeast, which produces a great deal of lift, but relatively little flavor or texture, especially in the crust, natural leavening makes an entirely different kind of loaf. Denser, darker and with a pronounced sour flavor. This is due to the combination of natural airborne yeast (not exactly wild since they have certainly evolved with human interaction) plus lactobacilli which lower the pH of the starter and kill off certain molds, fungus and other dangerous bacteria, something which no one in the past understood scientifically, but learned merely from trial and error. A dough made with natural leaven may take four or five hours to rise rather than one or two, but it is in this time that the crucial flavor and complexity develops. Baking with this sourdough starter began 4 October 2008 (named Durga for the Hindu Goddess, the unfathomable female principle of unforgiving rage and enduring endless love, whose festival occurs on this day).

This experiment also featured a predictable variable. My co-author (Rosanna Nafziger, *The Lost Art of Real Cooking: Rediscovering the Pleasures of Traditional Food One Recipe at a Time*) who lives 90 miles due west in San Francisco, replicated the procedure using the same feeding schedule for the starter, the same brand of flour (organic King Arthur Bread Flour) and equipment (a peel, baking stone, oven at 550°F, water tossed in the oven before baking to create steam.) The breads were even formed and slashed in the same way. But as everyone knows, San Francisco is home to a unique strain of yeast that thrives in the cold, foggy climate and is said to produce a sourness unlike any other in the world and, according to legend, maintained carefully from the days of the gold rush-era '49ers who were said to have carried their starters into the mountains (where the starter should actually have changed dramatically – a factor left out of the story). In any case, as predicted, the San Francisco- and Stockton-produced breads were absolutely nothing alike. Mine baked to a golden brown, my partner's had a distinct white exterior. Mine was dense with large open holes, hers lighter in color and with smaller holes. And predictably, hers was reported to be decidedly sour, whereas mine had a mere hint of tanginess. Clearly the yeast and, I would suggest, also the bacteria, the climate and the microbes on our hands were all together the crucial factor in explaining the difference between these two breads.

Cheese

For the next experiment I decided to cling closer to the historical sources for the methodology, to produce a traditional aged cow's milk cheese. Cheese is among those natural products that pretty much makes itself – or rather bacteria make it. This seems surprising to modern sensibilities, as we know very well that milk goes bad after a week. Actually, that is only when milk is pasteurized, when it has been heated to kill all the bacteria, good and bad, along with most of the flavor. Pasteurized milk does indeed rot if kept too long, even with refrigeration. But raw milk turns sour and tangy when invaded by lactobacilli. Certain strains cause the milk to solidify into yoghurt, some produce other cultured products like *kefir*, quark, etc. Thus this experiment would only be possible using raw milk, which fortunately is legal in California, though not in most of the US.

To stick as close to historic methods as possible I decided to use only liquid rennet, but no commercial starters, cultures or other additives. After all, I wanted to see what the bacteria would do on their own to milk, and see how people in the past would have made cheese. I decided to make something like a traditional bandaged wrapped white cheddar, rubbed with lard as I know it is successfully done a few miles from my house at an award-winning artisanal dairy – Fiscalini. I saw the procedure there with a class, but was nonetheless intent on taking my cues from historical sources.

I started with classical sources like Columella, found a handful of really useful Renaissance sources like Pantaleone da Confienza in the fifteenth century and Vincenzo Tanara in the seventeenth century, but none of these were even vaguely as detailed as

the eighteenth-century English author Josiah Twamley who, in *Dairying Exemplified* of 1784, describes every detail of cheese-making before industrialization. This is a précis of the directions I was able to glean from him and the earlier sources. It is scaled down for home production.

Start by warming two gallons of raw milk over a gentle flame: 90°F is about right. Be careful not to overheat it or you will kill all the good bacteria you want alive. Maintain constant temperature carefully for the whole process. If the milk is too hot, Twamley says you will have 'Sweet, or Funkey Cheese.' The milk is kept an hour at this temperature to allow bacteria to multiply. Next, mix 20 drops of liquid rennet into about a cup of cool water. Then pour into the milk and stir. Let this sit for about 45 minutes. Be sure not to disturb this in any way, or you may prevent coagulation. After 45 minutes, you will see that the curds have set, and it looks solid, perfectly coagulated. Not curdled – as you would see in milk gone bad – but a solid jiggling mass.

Then with a long, serrated bread knife, cut the curds, still in the pot, very gently into long, thin slices, and then cut across again. Don't break up the curds too much, essentially what you have now are long, vertical sticks. Let them sit for 20 minutes. Next, raise the heat to 98°F. Hold it at this temperature for about 30 minutes. You will see the curds gradually sink to the bottom and stick together a bit. It will be ready when the whey is no longer white but 'you will always find the whey quite green', says Twamley. In fall, the whey may take on a bluish hue.

Carefully lift the curds with your hands out of the pot into a fine-meshed colander or sieve – a Chinois shape works nicely. Try not to break up the curds violently or you will cause the fat to drain away too; all you want is the greenish, watery whey to drip out. Let drain about 15 minutes or until the whey stops dripping. Keep the whey for ricotta.

Return the curds, which will now look like cottage cheese, back to your pot. Add two tablespoons of salt and stir to distribute evenly. Leave to rest for another hour. You'll see more whey exude. Pour the curds into your cheesecloth-lined mold, and wrap up like a little wheel or cylinder shape, depending on your mold. Let the remaining whey drip down into the pot. Put a top on the cheese – I cut a circle of rigid plastic but a small plate will work too and weigh it down. Start with a little weight on top and gradually increase until there's a lot of weight pressing down on the cheese. Leave this to drain over night.

Take the cheese out of the press and unwrap. Put it on a reed or bamboo mat, anything that allows the air to circulate underneath, in your cellar or cool storage area (I use the wine fridge) at about 50–55°F and turn a few times a day for two days.

Lastly, you can either rub with oil or wrap the firm and dry cheese in leaves or several layers of clean cheesecloth or thin muslin and then melt about a cup of lard and brush it all around the cheese, saturating the cloth. You can also brush the cheese with melted paraffin wax. Put it back in your cellar, wait 12 months. Then eat.

In the course of a year and a half I made six cheeses (two are still aging) and altered certain variables. For example, using pasteurized milk created a cheese which molded and rotted. The right bacteria to cure the cheese wasn't present in the milk and apparently wasn't transferred by my hands or equipment. Bandaged cheeses dried out a little too much but also formed a nice crystalline texture similar to Parmesan. Waxed ones stayed softer and were a little milder. Slight variations in procedure made significant differences in texture and consistency. But the color and flavor of the cheese in every experiment that used raw milk was similar to the Fiscalini cheese made a few miles away. In some side-by-side taste tests, they were indistinguishable. Climate, soil, fodder certainly played a role, but I would contend that most important was the local bacteria in the milk. There is not another industrial cheese (among many) produced in the area that tastes anything like these. And the very fact that an amateur could produce a cheddar comparable to the professionals suggests that bacteria above all was the crucial factor in the expression of *terroir*.

Salami

The last experiment involves hard Italian fermented and aged salami. Reconstructing historical procedures was much more difficult than cheese, mostly because very little has been recorded, and hardly anything in food literature. Cookbooks, for example often tell you how to serve cured meats, and very often give directions for various cooked sausages, but the actual curing was always either done by professionals in cities whose trade secrets were not shared or on a small scale on farms where the pigs were slaughtered. Salumi was simply not something chefs or stewards regularly made. But there are glimpses here and there.

If the origins of salami manufacture are obscure, they are nonetheless just as natural as the discovery of cheese or wine, so let me turn to just a little basic chemistry to explain what's involved. I think it will also help to explain why there are real differences in flavor from place to place, because you are really depending on whatever bacteria and molds happen to thrive in a particular spot. Nowadays, and for the last 50 years or so, as with cheese, manufacturers use standardized commercial starters to get a consistent product and to prevent spoilage. They also tend to speed up the whole process to save money. The result is, to my taste, a really unpleasantly sour one-note salami without much character. The sourness happens because they are looking to lower the pH rapidly to prevent pathogenic bacteria. All these procedures of course ruin the natural and historically rooted flavors. You really need to depend on whatever nature gives you to get complexity and expression of local *terroir*.

Salami is simply chopped or ground meat in a casing of intestine that is aged by salting and drying and bacterial fermentation. In many instances that is all you need – the bacteria in the animal's gut and on the human's hands (lactobacilli, pediococcus, leuconostoc, etc.), combined with the right temperature and humidity, will work perfectly, especially in anaerobic conditions. It needs to be cool, hence slaughter in

autumn, usually after St Martin's Mass (11 November). The weather should not be too dry either or the exterior of the salame dries out too fast and the interior spoils, nor too cold. Italy happens to have an ideal climate, the further north you go in Europe the more difficult it can be without the right bacteria and too much humidity – which is why cured meats are more typically smoked in the Alps and northward.

The meat, in this case pork shoulder, is chopped or ground, or even pounded in a mortar and then salted. Historically, it would have been mined salt which has natural minerals, some of which aid in preservation, but if you are thinking of bright red classic salami, then saltpeter (or the modern equivalent sodium nitrite) is also necessary. Mined salt sometimes contains a high amount of nitrates, especially taken from caves where there are bats, but typically saltpeter has to be manufactured. Potassium nitrate is KNO_3 which historically was either mined directly from rock, hence the name *sal petrae*. Or it is made by taking a pile of manure, mixing with it wood ash and other decomposing vegetable matter – especially hay, covering it, and letting it basically compost. It's turned over, and kept moist with urine: a completely natural, if slightly unsavory process. Then, after a year, it is soaked with water, the water drained off, and left to dry into crystals. The principal use for saltpeter is of course not food processing but, when mixed with sulfur and charcoal, gunpowder.

Apart from its anti-pathogenic properties, the nitrite reacts with the myoglobin, which prevents oxidation which turns meat brown. This is not nitrate, but nitrite which is converted into nitrate by microbial action. Which is also why sugar is necessary in curing, not only to offset the flavor of salt, but to feed the micro-organisms that convert the nitrates. Of course how nitrates work in curing meat was not understood until modern times, and even though saltpeter was known to chemists from the late Middle Ages, it is very difficult to say when exactly it began to be used to cure meat. But it is from this time that we begin to find recipes.

Traditionally made salami is relatively unknown in the US since it is illegal to import into the US any raw meat cured less than 400 days – so prosciutto can be imported, salami can't. One hundred days is about when salami turns to rock. But we have domestically produced salami, an excellent example of which comes from the Bay Area – made by Paul Bertolli. I interviewed Paul in Berkeley at the Fra Mani factory in October 2009. Paul came to fame as a chef at Chez Panisse with Alice Waters, and then opened his own restaurant called Olivetto in Oakland. Apparently having become so enthralled by curing meat, he left to work full-time at his own salami factory – and wrote a great cookbook called *Cooking by Hand*.

He has been striving to recapture old salumi-making traditions by rejecting mass manufacture, and quick industrial procedures. Obviously to produce on any scale and follow USDA regulations he has to adopt certain food safety standards and has to have a government inspector on hand all the time. One outbreak of listeria could put him out of business, so the machines have to be scrupulously clean. I wasn't even allowed in the processing part of the facility. But I got a very good idea of how salami is made there,

and how different it actually is from traditional salami-making (which incidentally is practically extinct in Italy, as it is in the US).

Paul is part of the more recent wave of producers who are looking for small-scale, artisanal and traditionally manufactured specialities. Well, what does that actually mean? First, Paul told me that the most important factor is the quality of life for the pigs, which directly affects the quality of meat. His are sourced from family farms in the Midwest through Niman Heritage (no longer connected to Bill Niman, incidentally). (Most of the older producers like Molinari just buy wherever the pork is cheapest – usually Denmark.) The Niman pigs are allowed to roam outside on open pasture but have little portable hoop barns that they can go into for giving birth, they are not given antibiotics (necessary when pigs live very close together indoors) nor growth hormones. A sow usually gives birth to about ten to fourteen piglets per litter. They are weaned at six weeks and after about six to seven months are big enough to go to market. That's about 300 lb on the hoof or about 200 lb dressed. Fra Mani processes about 100 pigs per week, and the time from slaughter to production is about a week. The meat never arrives frozen, but is always fresh. The rearing practice and speed from slaughter to processing helps avoid PSE (pale soft exudative) meat, which happens when the pH lowers and the muscle proteins denature resulting in mushy meat. The scale here is also very small. Only twenty people work at this factory – and that apparently helps maintain the quality of the meat

The important part is cutting it into primal sections, avoiding the sinews that would make salami unpleasant to chew. It is then ground with various successively sized blades, because you want some chunks large, others more finely cut to give texture to the finished product. And you want clearly visible knobs of fat, not smeared sections. The final product has about 18–22 per cent fat. Then fermentation cultures are added: staphylococcus, pediococcus, lactobacillus. What these do is bring down the pH so the good bacteria that cure can thrive and the bad bacteria perish. But note, these are commercial starters. They add flavor, texture, color – and consistency. As does, of course, the salt. The pH needs to be an acidic 5.3 to kill salmonella and the like.

The ground meat is then mixed with a paddle, which helps it adhere, then goes into a stuffer, goes in literally by hand into a natural casing only made of pork (not beef middles which can carry e-coli). The section of intestine determines the width of the final salami, ranging from small to sow-bungs which are 120 caliber. All are hand-tied with linen or hemp. The reason for this is that they're all naturally irregular in size and shape and a machine really could not do it well.

Then they are hung to ferment in special chambers that control temperature (about 70–75°F) and humidity for a week, before penicillin mold is introduced to the exterior, similar to blue cheeses. This is essential for flavor as well as for regulating the flow of moisture through the skin. The mold is sort of gatekeeper. The real trick is to dry at a regular pace. If the exterior dries too quickly it prevents the interior moisture from migrating to the surface. If done properly, the salami will lose 40 per cent of its water, becoming harder and shrivelled.

The answer Paul gave me to one particular question was really surprising. He said that these salami are 'uncured', which was baffling. I asked whether he used nitrates to keep deep red myoglobin. He said, 'No, we use celery juice.'

So I am wondering, 'You mean, if I squeeze the water from celery it will prevent botulism?'

'No it's actually concentrated celery juice. But legally there are no 'nitrates' (normally synthetically manufactured) as defined by US law, so it can be labelled as uncured and thus sold in Whole Foods. Only this way can it be labelled organic. But the celery juice is in fact an abundant source of nitrates.'

The stuffed salami is next aged for at least 32 days, or as long as 65 for the *salami gentile*, which is cured in a rather thick casing. Nostrano is aged for 70 days, Toscano for 90–100 days, the typically harder *sopressata* about the same. They are never wrapped in plastic or shrink wrap, because like cheese it needs to breathe. They are sometimes refrigerated at markets, but this is unnecessary.

Despite the small size of the Fra Mani factory, it is still salami made on an industrial scale, and they still have to follow USDA regulations. If the slightest trace of listeria, for example is found, they have to shut down production and do an IVT, intensive verification testing. And every 45 days every piece of machinery and surface is thoroughly inspected and sterilized. And naturally as a business, if anything goes wrong, and a customer gets sick, they are in serious trouble. Nonetheless, I have to admit, and you will see, he does achieve some funky intense flavors.

At home you can be looser with regulations. Listeria is just as likely to show up on your cutting board as in home-made salami, and the same is true of salmonella, and trichinosis is really not a concern any more unless you're using wild boar. So I thought I'd share the much simpler procedure, which is not only less complex, but depends on whatever bacteria you happen to have in your kitchen and of course truly replicates historic methods. It is salami made the old-fashioned way. And I should say here that if you scrupulously use antibacterial soap it will be much harder to ferment anything, because you've killed all the good and bad bacteria.

I have made salami literally by hand with no machinery about ten times in the past year and a half, including with a class of twenty at Boston University and about 30 lb of meat. Start with either beef middles which give you a nice fat salami, or with pork casings. It has to be natural – again we want bacteria. Soak these about half an hour to remove the odor. Then take 5 lb of pork shoulder – you can either buy a whole roasting joint which is a little tricky to cut up and remove all the sinews from; or you can use what are called country ribs, which come from the shoulder or loin; or even pork steaks which are also shoulder cut flat. In either case, I cut the meat into smaller fist-sized hunks and put it in the freezer to keep firm – replicating the winter-time slaughter outside. There should be enough fat on this, which should be about 20–25 per cent. If you need more fat, just add a little fatback, with the rind removed. There are two ways to do this. One is with a meat grinding machine, which is quite tricky because the fat can smear and the

meat can be over-worked. I once owned a hand-cranked meat grinder but I tossed it in the trash about a year ago, in a fit of rage. You really want a mix of larger and smaller bits, but absolutely distinct little nubbins of meat and fat. The best method is to get out a good, heavy, very sharp knife and cut it all by hand.

Take a few hunks of meat at a time and put the rest back in the freezer while you work, because if it gets to room temperature it gets slippery and much harder to cut cleanly. Cut the whole thing, fat too, into neat little nubbins about the size of a pencil eraser top or smaller. Here the proportions of cure are very important. Add 3 ½ tablespoons of sea salt, 4 tablespoons of sugar, not to make it sweet, but necessary for the fermentation and 1 teaspoon of pink curing salt, Insta Cure™ #2, sometimes called Prague powder II. The flavorings are up to you: I usually use oregano, pepper and either fennel or a touch of a spice mixture I keep around made of cinnamon, cloves, nutmeg, cardamom and ginger, similar to the French *quatre épices*. Just a pinch of mace would be fine too. Garlic would be classic. Then add a quarter-cup of red wine and mix it all well with your hands. Doing the whole thing by hand is what really introduces the bacteria here. It probably helps that I've got sourdough bread starter on the countertop – and pickles fermenting in the cupboard.

If you really want to learn the meaning of the word hand-made, get a wide-mouthed funnel and push the opening of your casings onto the end, wetting them well first so they slide on. But you don't even need a funnel, it can be done with your hands. Push on about two feet-worth. Tie the end of the casing off in a knot once it is on your funnel. With funnel in one hand, stuff your mixture into the opening and it will gradually fill the whole casing. Remove your sausage and tie off the other end. Twist it in the middle and tie with a string and you will have two foot-long salamis. The 5 lb of pork should make about twelve feet. You can also tie string around the knots which keeps them from untying and you can hang the salamis from the string.

Then hang these in a cool place, at around 55°F with a moderate humidity – also necessary so they don't dry out too quickly on the outside, preventing the inside from drying evenly. A wine fridge works well for this. In about four weeks they should be ready. They will lose about 35–40 per cent of their moisture, so you will have rather small *salametti* at the end. An even longer aging is fine if you want them to be harder. If you see flecks of white mold that's perfectly fine. In fact, you can encourage it by buying a commercial dry salami with mold on it and putting it in with yours. The mold adds to the flavor and helps preservation. It is the gate-keeper, so to speak, regulating the exit of moisture and development of flavor.

If you find the casing a little too chewy, feel free to peel it off. The fat inside the salami will be soft and yielding and balances beautifully with the firm deep red flesh. These will keep several months, becoming even drier and more complex in flavor. They can be stored at room temperature too. I have some that have been hanging in the kitchen since the spring, rock hard but really very tasty if sliced razor thin.

The salami experiment above all other proves that place and local bacteria are a key if not the essential factor in what we call *terroir*. This salami tastes absolutely nothing like any I have tasted in the US or in Italy. It is very slightly sour, quite hard and chewy, with an aroma that I can imagine is the result of whatever this distinct bacterial ecosystem has done to the meat. But it tastes nothing like mass-produced salami or the artisanal USDA-regulated salami now so popular in the US. I wish there were a way to compare it to others made with the same process, but that's a subject for further investigation.

Sources used in reconstruction of techniques

d. 149 BC Cato the Elder, *De re agricultura*.
d. AD 70 Columella, *De re rustica*.
d. AD 102 Martial, *Epigrammata*.
d. AD 217 Galen of Pergamum, *Alimentorum facultatibus*.
4th century AD Apicius, *De re coquinaria*.
d. AD 815 Geber (Jabir ibn Hayyan).
1242 Roger Bacon.
1270 Hasan al-Rammah.
c. 1460 Martino of Como.
1470 Platina (Bartolomeo Sacchi), *De honesta voluptate*.
1477 Pantaleone da Confienza, *Summa lacticiniorum*.
1491 Antonius Gazius, *Corona florida medicinae*.
1535 Agnolo Firenzuola, *In lode dells salsiccia* .
1542 Giulio Landi, *Formaggata di Sere Stentato*.
1549 Cristoforo di Messisbugo, *Banchetti*.
1556 Jodoco Willich (Conrad Gesner), *Ars magirica* and Jabob Bifrons's letter.
1564 Agostino Gallo, *Le vinti giornata di agricultura*.
1569 Hortensio Lando, *Commentario della più notabili e mostruose cose d'Italia*.
1570 Bartolomeo Scappi, *Opera*.
1581 Alessandro Petronio, *De victu Romanorum*.
1584 Giovanni Battista Rossetti, *Dello scalco*.
1586 Baldassare Pisanelli, *Trattato della Natura de Cibi e del Bere*.
1653 Vincenzo Tanara, *L'economia del cittadino in ville*.
1784 Josiah Twamley, *Dairying Exemplified*.