particles in the air and in the soil which, thus assorted and combined, are food for man. Such is the theory, and the practice bears it out; for in reality the farmer does but direct a succession of processes whose effect is to detach these particles from useless positions in the earth, air, and water, and comparatively useless positions in substance of plants, in order with them as material to erect the structure of the ripened crop in one case, and of the fattened animal in the other. His every act of cultivation, by assisting the action of atmospheric solvents, loosens these atoms from previous combinations in the soil—his manuring is a direct addition to them—his draining furthers their more ready transmission to the roots of plants- the hoeing by which he stimulates the growing crop, accelerates their building up into its substance—and all the details of their preparation as food have for their aim the easiest and most economical collection of these particles for the use of man either as vegetable food or as meat on the bodies of fattening animals."

We have already seen that the air is the great storehouse from which the bulk of a plant is derived, and that the value of a manure and the fertility of a soil are owing in great measure to the nature of the mineral food for plants which they respectively contain. We must not think that manuring merely *induces* the extra crop, we know not how. Along with air the manure furnishes the very building material out of which the increased produce is *made*. Those very atoms of nitrogen and phosphorus we are adding in that guano, bone-dust, or farm dung—those very particles of potash or of soda which are detached from the soil by the influences which drainage has brought to bear—those very particles of carbon which our plants, vigorous owing to more thorough cultivation, are extracting from the air in the sunshine, may travel different roads, but they will come to an ultimate residence side by side on the flesh and blood of the fattening animal. The various additions we make to our soil, the fertility we extract from it, may be said to occasion the increased produce of grain and and meat which succeeds them, but it is in the same way as the stone and the lime *occasion* the buildings of which they are the very substance and material Strange as it may seem to those who see the manure continually added to the land and the wheat continually taken from it—the dung-cart going and the harvest-cart returning—a plant has no power to convert one thing into another; it can but take the particles we give it. It will flourish if they are food, it will starve if they are withheld, and if they are poison it will die. There is no mysterious connection between a heavy dressing of dung applied to the land and a heavy crop taken from it: it is not the weight, it is the composition of the dressing that must be considered the measure of its value. The crop finds in the manure the very particles which it needs as building material—drainage and tillage are the hodmen who bring these building materials to the growing plant—plants are at once the masons who put them together and the erection that is in process of completion—and the whole procedure goes on under the eye and according to the laws of the great Master-Builder who contrived the whole wonderful system of vegetable growth, and conferred the life which puts it in exercise.

It is this way of looking upon the growth of the plants, and indeed of the animals also of the farm, which brings out the resemblance which really exists between the business of the farmer and that of the manufacturing chemist. In both certain materials provided by art and nature are made to act and re-act on one another, with a view to the resultant produce which has a value in the market more than enough to repay all the expenses of the process. The farmer, whether he knows it or not, is truly a chemical manufacturer: he may talk of his plowing, sowing, manuring, cultivating, but the real agents at the bottom of all are those laws of the science of chemistry which regulate the combination of the different substances which he uses, and which out of earth, air, and manure, thus provide food for man and beast. It is a true resemblance which exists between the two professions. The fact that life is an agent in the one case and not in the other does not spoil this resemblance. Life in the one case is but the steam engine in the other—the source of power which lifts and mixes, and fetches and carries; the laws of chemical affinity, which are the real agents in both the cases, prevail in the vessels and tissues of the of living plants and animals just as they do in coppers and retorts of a chemical manufactory. The comparison between the two is, therefore, *just* as well as instructive.

See now if we cannot learn as much from their contrast. In the one you have an art whose processes are all conducted with the greatest nicety away from the influence of any disturbing cause—whose materials of known composition are weighed with accuracy and mixed in the right proportions—whose agents are applied just in the right degree at the proper time and place—its furnaces may be reduced in intensity, or heated at will seven times hotter. In farming on the other hand, you have an art the most at the mercy of unmanageable elements, whose processes are exposed to wind and weather, storm and calm, rain and sun, heat and cold, on whose practice there exist the greatest differences of opinion among those engaged in it. Consider on the one side, varying soil, changeable climate, clumsy implements, uncertain materials, contradictory rules and maxims—this is a picture of our agriculture. On the other side you have every where exact weights and measures, known materials, uniformity of process, and rigid exclusion of disturbing influences.

Nothwithstanding the superiority in all the respects of the chemical manufacture, the manufacturer seeks the aid of science for the super-