MS 2036

[Photographs, diagrams etc relating to early Establishment work, at Porton Down, on various processes, including the continuous fermentation process. (NB Only photos etc listed; there is also additional unlisted material)]

/1	1943 Feb 10	Stainless steel milk churns for growth of bacteria (2 photos)
/2	1943	An early multiple batch process in which there was no change of medium, no stirred aeration, no pH control and no direct observation of growth procedure (1 label only)
/3	1952	Shows air spargers and associated equipment; also the method of sealing the churn lid to maintain strain purity (3 photos)
/4	-	An early type of stainless air filter with air provided through an Edwards pump and trap bottles (1 photo)
/5	1968	The Porton Down Enclosed Chemostat. This new patented apparatus satisfies the need for a completely self-contained enclosed unit which can be used by the research worker to study pathogenic material. The cabinet, which is built of fibreglass for lightness and convenience of construction, is divided into three compartments. The top compartment is the process chamber containing the growth vessel, medium and culture reservoirs. All components can be manipulated through the sealed gloves at the working front. It also contains, apart from the necessary services, means for pipetting, plating and incubating culture samples so that culture need only be removed from the cabinet for processing or destruction. The lower compartment is separate from the top and is for the collection of culture in sealed sterile containers. At the rear of the lower compartment and directly below the culture apparatus is an accident well accessible from the front through a sealed port. On the right side of the cabinet is the instrument compartment. Ventilation of the cabinet is by means of a small vacuum cleaner drawing air into the cabinet and exhausting it through fibreglass filters. The unit has passed rigorous safety tests. The entire apparatus can be autoclaved in one piece and the whole can be broken down, washed, resterilised and set up

		again in one day whereas any of the previous equipment required a week to a fortnight to prepare. Recovery of cells by sedimentation (5 photos)
6	-	[Water Pollution Research Laboratory for Coal Board. Phenol metabolism] (1 photo)
7	1957	[Continuous fermentation vessel (Evans 1ST) used for phenol metabolism] (2 photos)
8	1959	[Continuous fermentation. Used for phenol metabolism (Evans Mk. 2)] (1 photo)
9	1955	The 1953 apparatus was divided into sections mounted on trolleys and enclosed within a cabinet. It was designed to be operated by remote control using valves operated from the front panel. The glove box was mounted on one end of the cabinet and all sampling, inoculation and harvesting was carried out from this point. Magnetic drive was introduced from an electric motor through the roof, the motor separated by a shroud. Speed variations from 0 - 1400 r.p.m. were available. A sigma pump controlled medium supply. Control of pH took place only at the start of a run. The cabinet was maintained at a negative pressure of 2½" - 3" water gauge. Sampling and harvesting was effected from the base of the glove-box by screwing on connection lines. Both these operations were open to the atmosphere. The apparatus was complicated and awkward to work, but runs using *Staphylococcus aureus* and *Brucella abortus* for early vaccine production, were carried out in it before the work was transferred to the Veterinary Research Laboratories at Weybridge. [Cabinet for continuous culture] (3 photos + 1 untitled diagram)
10	1959	This was essentially the same apparatus but somewhat modified. The glove box was now situated at working level and inserted into a space previously occupied by a second apparatus. Filtered air ventilation was introduced (using a mercury flap-valve) so were air, and air and formalin locks for getting objects in and out of the cabinet. Automatic pH control was introduced and sampling could be done within the cabinet. The apparatus could be autoclaved in two sections. Initially this apparatus was used for studies of *Pasteurella pestis* (plague) for vaccine production. Later it was used to grow harmless bacterium for use in research on sewage

		outflow in British coastal waters. [Cabinet Mk.2] (3 photos + 4 diagrams) Diagrams: - one untitled; system for sampling effluent process air, suction air, cabinet air and formaldehyde vapour; antigen 3 production as a function of time after temperature rise, 28º - 37º (pH 7.3); antigen 4 production as a function of time after pH changes at 37º
11	1953	An all-metal plant is not an ideal experimental unit; even minor changes or improvements require major engineering services. A more flexible glass and metal apparatus was constructed which could be easily broken down and autoclaved in four separate units. The apparatus consisted, as shown, of a Pyrex glass reactor vessel with stainless steel top plate. The impellor shaft, driven by a turbine, entered the vessel through a glandless seal, a cooling coil surrounded the stator. Impellor speed was controlled by a Variac transformer. Medium was fed into the reactor from a reservoir by controlled air pressure. pH was maintained by hand control and antifoam introduced at a predetermined point. Temperature was controlled by a 650w. electric hot plate. The product was collected in receivers below the reactor. This apparatus was not enclosed and was not suitable for the study of pathogens. [All purpose continuous fermenter] (3 photos + 1 diagram) Diagram:- continuous culture system incorporating Sadd turbine
12	1948	One of a battery of twelve Units for the growth of microbes. These were grown in cellophane sacs washed by a continuous flow medium. Serum containing bacteria was circulated and aerated within the sac by an airlift system. Medium was circulated around the sac, from the bottom up, then turn out of the unit into a collection bottle. This medium supplied nutrient and maintained pH by osmosis. Bacteria were drawn off from the bottom of the sac into sterile containers. This apparatus was used in early production of anthrax vaccine (1 photo)
13	[c.1965]	[Apparatus for continuous culture of non-pathogens] (6 photos)
14	-	[Enclosed centrifuge developed after 5 (above)] (3 photos)
15	-	[Large Permex (see 5 above)] (2 photos)

16	[1961 - 1962]	[Apparatus for continuous production of penicilla (AC-lase) at Beecham] (3 photos)
17	1952	An experimental unit for vaccine production using either the batch or continuous culture method. The unit consisted of three stainless steel reactor vessels enclosed within a sealed cabinet. Each reactor was complete in itself, with a jacket for steam, tempered or chilled water. It has a sterile air supply and an effluent air disinfection system. Each reactor could be used alone or coupled to one or both of the other reactors. A slight negative pressure was maintained within the cabinet and reactors to protect workers. The whole interior of the cabinet could be sterilised and disinfected with a steam and formalin mixture (1 label only)

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