

## Technical description of the Biotron

The Biotron is a facility for research where climatized rooms are demanded with respect to high precision and accuracy on the regulation of climate factors such as temperature, humidity, light and CO<sub>2</sub>. The facility is primarily designed for plant research, but can be used also for other areas of research with demands on access to climatized rooms which allow a high degree of control and sanity. The new Biotron is expected to have a technical longevity of 30 years.

The new Biotron comprises of, in total, 24 different rooms of four different types of rooms with varying demands on climatization. There are 12 climatized rooms with artificial light (KK), 4 climatized rooms with daylight, supplemented with artificial light (DK), 4 growth chambers (OK) and 4 greenhouse chambers (VK). All rooms are individual and there is no influence between chambers. They are split in two different zones, separated from each other completely as regards impenetrability and access. The zones are accessed through an air lock. A considerable part of the Biotron meets the standards, required for research in enclosed facilities, avoiding contamination of other facilities or the environment. All rooms and chambers have surveillance of climate and alarm functions. If there is an alarm, technical staff will always take measures to correct. There is staff on duty outside normal working hours. The use of energy for the entire facility is optimized by recovery of excess heat. This, however, does not apply to the greenhouse chambers (VK), which are ventilated with traditional wall and roof ventilation openings.

The technical description and operational conditions for the different types of climatized rooms and chambers will allow a wide scope of research. There will also be increased possibilities to accommodate the choice of room or chamber to the actual specific technical needs and other requirements, i.e. enclosed cultivation of GMO plants, than in the present facility. These features will make the new Biotron even more attractive for plant research than the present facility.

### **Climatized rooms, KK**

All rooms have high precision and accuracy on the control of temperature, humidity, light (artificial) and CO<sub>2</sub>. Climatization is carried out with circulating air. A minor part of the air is continuously exchanged to secure the level of CO<sub>2</sub> (depending on demands on control of CO<sub>2</sub>) and to ventilate undesirable gases. This air is passing through HEPA-filter. The use area of the rooms is ca 11,5 m<sup>2</sup> with a free height of 2,3 m. There is access to cold tap water, de-ionized water, compressed air, electrical sockets and sockets for cooling. All rooms meet the requirements for enclosed cultivation. There are different configurations on light and operational conditions:

Config. 1 (5 rooms)	Temperature +2 °C – +35 °C Air humidity 5-30 g/kg, 30 – 90% Light 75 – 600 $\mu\text{mol m}^{-2} \text{s}^{-1}$ , metal ceramics halogen CO <sub>2</sub>
Config. 2 (2 rooms)	Temperature +2 °C – +35 °C Air humidity 5-30 g/kg, 30 – 90% Light 50 – 600 $\mu\text{mol m}^{-2} \text{s}^{-1}$ , LED allowing alterations of the spectral signature CO <sub>2</sub>
Config. 3 (2 rooms)	Temperature +2 °C – +45 °C Air humidity 5-30 g/kg, 30 – 90% Light 75 – 600 $\mu\text{mol m}^{-2} \text{s}^{-1}$ , metal ceramics halogen CO <sub>2</sub>
Config. 4 (3 rooms)	Temperature -5 °C – +35 °C Air humidity 5-30 g/kg, 30 – 90% Light 75 – 600 $\mu\text{mol m}^{-2} \text{s}^{-1}$ , metal ceramics halogen CO <sub>2</sub>

### **Climatized rooms with daylight, DK**

This type of climatized rooms is not available in any other facility in Sweden. The room allows high precision and accuracy as regards temperature, humidity and CO<sub>2</sub>. The light is natural through transparent panels and can, thus, not be controlled. The panels are composed of glass in several isolating layers. There will be possibilities to install supplementary light fittings (assimilation lighting). The lighting can be controlled on-off via a time channel, or by the level of natural light. DK is a room which is completely sealed off from the outside. Climatization takes place with circulating air. A minor part of the air is continuously exchanged to secure the level of CO<sub>2</sub> (depending on demands on control of CO<sub>2</sub>) and to ventilate undesirable gases. This air is passing through HEPA-filter. There is no installation for shading. There are curtains between the rooms to prevent undesirable light from adjacent rooms, i.e. from installed supplementary lighting. The use area of the rooms is ca 14 m<sup>2</sup> with a free height of 2,3 m. There is access to cold tap water, de-ionized water, compressed air and electrical sockets. All rooms meet the requirements for enclosed cultivation. All rooms have the following operational conditions:

Temperature +6 °C – +35 °C  
Air humidity 5-30 g/kg, 30-90%  
CO<sub>2</sub>

### **Growth chambers, OK**

These chambers are designated for research activities with less stringent demands on climatization. All chambers have functions for the control of temperature and light, but there is no control of air humidity or CO<sub>2</sub>. Climatization takes place with circulating air. A minor part of the air is continuously exchanged to secure the level of CO<sub>2</sub> (depending on demands on control of CO<sub>2</sub>) and to ventilate undesirable gases. This air is passing through HEPA-filter. The use area of the chambers is ca 8 m<sup>2</sup> with a free height of 2,3 m. There is access to cold tap water, de-ionized water, compressed air and electrical sockets. All chambers meet the requirements for enclosed cultivation. All chambers have the following operational conditions:

Temperature +5 °C – +35 °C

Light 50 – 250 μmol m<sup>-2</sup> s<sup>-1</sup>, T5 fluorescent tubes

### **Greenhouse chambers, VK**

These chambers are designated for research activities with less stringent demands on climatization. All chambers have functions for the control of temperature and air humidity, but there is no control of CO<sub>2</sub>. There will be possibilities to install supplementary light fittings (assimilation lighting). The lighting can be controlled on-off via a time channel, or by the level of natural light. Too high temperature is regulated by ventilation through wall and roof openings. Panels comprise of glass in several isolating layers. There are curtains between the chambers to prevent undesirable light from adjacent rooms, i.e. from installed supplementary lighting. There are curtains for shading, which are controlled via a time channel or by the level of natural light. The use area of the chambers is ca 14 m<sup>2</sup> with a free height of 2,3 m. There is access to cold tap water, de-ionized water, compressed air and electrical sockets. Due to the ventilation through openings, these chambers are allowed for enclosed cultivation only for part of the year. All chambers have the following operational conditions:

Temperature – up to +20 °C at -20 °C outside

Air humidity – max humification with 8 lit per hour