The authors reported the remarkable levels of galactosamine in addition to glucosamine among the breakdown products of chitin which is one of the major constituents of fungal cell wall. The other methods, colorimetric or by HPLC developed for detection of hexosamines in fungal cell wall chitin were not capable of differentiating glucosamine from galactosamine.

After the clarification of some key factors related to aflatoxin biosynthesis it was thought worthwile investigating the effect of the most common anti-oxidants on growth and aflatoxin production with the hypothesis that they could possibly be used succesfully for control of aflatoxin production 'in vivo'. 'In vitro' BHT, BHA, cysteamine and sodium thiosulfate were capable of reducing or blocking aflatoxin output induced by lipoperoxides or halomethanes in cultures of Aspergillus without affecting fungal growth. Moreover, under some culture conditions other antioxidants (vitamin C, vitamin E, cysteine and reduced glutathione) further enhanced aflatoxin biosynthesis.

'In vivo' the results reported were different: BHA, BHT and sodium thiosulfate alone or in association, were capable of inhibiting both aflatoxin output and fungal growth as compared with control. Relative humidity of the seeds affected the stability of antioxidants added to them; the drier the seeds, the lower the rate of decomposition of antioxidants. This influence on the stability of antioxidants was taken into account.

In conclusion, it seems evident that the use of different methods for preventing fungal contamination such as controlled atmospheres or by using chemical compounds to reduce the presence of microflora is a good approach to limiting microflora and mycotoxin production in food and feed.

SYMPOSIUM 3: PHYSICAL AND ENVIRONMENTAL CONTROL

H.J. Banks, Australia.

Three review papers were presented in this Symposium - that of Annis on CO2 and nitrogen based controlled atmospheres (CA) and their effect on insects, that of Evans on the limitations to the use of heat and cold in the control of stored product pests, and that of Banks on the potential of shock, physical removal and exclusion for insect control. There was no review paper presented on the very topical subject of radiation disinfestation, but two of the submitted papers covered many of the important points concerned with its use.

Annis gave an integrated summary of the literature data on the effect of CAs on stored grain insects. His survey was limited to data for between 20 and 30°C and he noted particularly the lack of data below 20°C. His survey highlighted the extensive deficiencies in the data, notably on the response of Trogoderma granarium, one of the more tolerant pests. Sitophilus oryzae pupae were clearly the most difficult pest and stage to kill with CA. The framework he set up should be useful for logical planning of future data gathering.

Reichmuth provided some much needed data on response of stored-product insects to 0.5-4%O_2 atmospheres at temperatures below

20°C. He used a hermetic not continuous flow exposure system in his experiments. In discussion C. Bell noted inconsistencies between his data and Reichmuth's. In particular he found 0.5%O_2 atmospheres to be more effective than 1%O_2 whereas Reichmuth did not. The difference may be due to different experimental technique.

Evans surveyed the limits to the use of heat and cold. He pointed out that the much quoted reviews of Howe and Burgess do not give the temperatures to which grain must be cooled to halt reproduction but only to slow it to a defined level. The temperature at which reproduction ceases is 2-3°C lower. Neither the high or low temperature regimes required to eliminate insect pests produce noticeable(?) grain damage. He said that the information on the response of insects to heat and cold is bitty and that with one exception from Bahr, there was no evidence for geographic variation in tolerance.

Banks attempted to reawaken interest in three physical control systems, shock, physical exclusion and removal. He pointed out in particular that these methods appear to have substantial potential for use, perhaps in combination with other processes and that they required research to quantify and optimise them.

Wiendl and Buscarlet both gave papers on aspects of disinfestation with gamma-rays. Wiendl noted particularly that the temperature at which the irradiation was carried out was important. Both Wiendl and Buscarlet reported that the atmospheric composition altered the response of the insect to irradiation. Wiendl, during discussion, noted that high oxygen atmospheres enhanced the effect. Buscarlet found that low oxygen atmospheres were protective when used simultaneously with irradiation, but complementary when used consecutively, with holding under nitrogen after irradiation being particularly useful. This combination appears to solve one of the main problems of irradiation, namely, post-treatment survival of sterilised insects. Under nitrogen these insects died quickly.

Fleurat-Lessard gave a paper on the full scale application of burner CA in France. Despite long exposure (3 weeks) under low oxygen there was still some survival of S. granarius late larvae and pupae. Currently the costs of CA are too high to be attractive in France because of excessive gas consumption to maintain the atmosphere in the face of leakage from the poorly sealed silos available.

There were two main themes running through this Symposium - the need for further data to support the various physical control measures discussed and the usefulness of combinations of techniques under conditions where a single system is inadequately effective. Contributors highlighted several areas where additional research seems warranted.