5 Summary

In this work the role of the MAPK p44/42 and MAPK p38 cascades in associative appetitive olfactory learning, and also in non-associative learning has been described in detail.

Using high specific antibodies against MAPK p44/42, phospho-MAPK p44/42, MAPK p38 and phospho-MAPK p38, it was possible to quantify these proteins. The pharmacological inhibition of a MAPK p44/42 activation allowed not only *in vitro* but also *in vivo* manipulation of the MAPK p44/42 cascade. Using both phospho-dependent and phospho-independent antibodies allowed localization and determination of the MAPK p44/42 activation time window after single and multiple trial training *in vivo*.

Thus, the increased phosphorylation level of MAPK p44/42 was observed only after multiple forward conditioning. In the antennal lobes, MAPK p44/42 was significantly activated 40 min after training, whereas in the mushroom bodies at 40 and 120 min after training. Neither multiple backward, nor single forward conditioning altered level of MAPK p44/42 phosphorylation. The phosphorylation level of MAPK p38 was not effected by learning.

Immunohistochemical studies demonstrated the presence of MAPK p44/42 in the antennal lobes and mushroom bodies, but also in optical lobes. MAPK p38 was localized in antennal and optical lobes, and staining in mushroom bodies was rather weak.

In a series of experiments with olfactory conditioning combined with inhibition of MAPK p44/42 activation shortly before (30 min) and shortly after (30 min

and 2 h) training revealed involvement of MAPK p44/42 in long-term memory formation. Neither habituation nor sensitization were affected by the drug. It was also shown that MAPK p38 does not interfere with olfactory appetitive learning in the honeybee.

The difference in time courses of MAPK p44/42 activation in the antennal lobes and mushroom bodies suggests either a different contribution of MAPK p44 and MAPK p42 isoforms to formation of long-term memory or a different activation of the MAPK cascade by yet unknown signaling pathways.