SUMMARY

In my thesis, I aimed to characterize the changes in neuronal activity in the central nucleus of the inferior colliculus (CIC) in adult rats who suffered from a lack of auditory stimulation during their postnatal development caused by the temporary increase of auditory hearing thresholds after brief noise exposure on postnatal day 14 (broad-band noise, 125 dB SPL, 8 min). At the age of 3–6 months, the responses of individual neurons in the CIC to sound were recorded in these animals and compared with those of age-matched controls.

We found that the neuronal response thresholds were similar in the exposed and control animals. However, the response properties of high-frequency neurons in the exposed rats had characteristics typical of the immature auditory system, i.e. significantly wider excitatory response areas (which indicates impaired frequency selectivity), a longer first-spike latency, a narrower dynamic range, lower maximum response magnitudes, a steeper slope of the rate–intensity functions and a significantly lower percentage of monotonic neurons. On the basis of these findings, we investigated whether the reported alterations of neuronal responsiveness are also accompanied by abnormal behavioral responses to sound. The results showed a reduced strength of the acoustic startle reflex (ASR) observed in exposed rats compared with controls. The efficacy of prepulse inhibition of ASR in exposed and control rats was also markedly different.

To summarize our findings, a brief exposure of juvenile rats to noise led to a significant worsening of the frequency selectivity and frequency-dependent alterations of the sound intensity representation in the inferior colliculus of adult rats. The alterations of neuronal responsiveness were accompanied by altered behavioral responses to sounds in adulthood, indicating anomalies in intensity coding and loudness perception.