Expression of the Truncated Vasotocin Receptor in *Carassius auratus*

Katherine McNeil, 2012

Though we may think of our emotions and reactions to the outside world as more complex than something as simple as a few chemicals, it has already been shown that the racing mind, sweaty palms, and quickening of the heart associated with stress, the response to looming deadlines or a dark figure in a lonely alleyway, can be at least partially attributed to the release of glucocorticoids, a group of hormones from the adrenal glands (Klein et al, 2001). If stress can be so clearly linked to a neuroendocrine pathway in the nervous system, then why not other emotions, such as love, anger, or attachment? While these emotions may be more complex than stress and might therefore be governed by more complex molecular mechanisms, neuroscientists have already begun to make fascinating discoveries about the chemistry behind aggression and attachment. They have shown that vasopressin (VP) plays an important role in regulating monogamous behavior in mammals, and even if a small portion of the genetic sequence is altered for its receptor, drastic changes occur in monogamous attachment behavior (Winslow et al, 1993).

*Carassius auratus*, goldfish, have been found to have a similar chemical, called vasotocin (VT), which plays a role in their courtship and aggression behaviors. It has been shown in experiments in which goldfish were injected with VT that some fish showed decreased social approach behavior (Thompson and Walton, 2004). Interestingly, during the mating season, goldfish sensitivity to VT increases, just at the time when approach behavior is necessary for copulation (Walton et al, 2010). Meaghan Kennedy, a former student in the Thompson lab, found that a source for this variation might come from an alternative gene that codes for a short version of the VT receptor. It appears that in addition to a gene for the functional receptor that binds VT when it is released and thus mediates the animal’s behavioral effects, there is another, short version of the gene that codes for a related, but smaller protein, that could not function as a receptor. The short version of the VT receptor, though, could interact with the full receptor to modulate the effects of VT, or prevent the functional receptor from working properly. Through my project, I hoped to determine whether this receptor is expressed, and whether the expression level changes in different social situations to elucidate the function of the truncated VT receptor.

I used a northern blot to determine expression of the truncated VT receptor, for which we had two probes: one for the canonical receptor and one for the truncated receptor that bound to both canonical and truncated RNA sequences. After observing fish under different mating conditions, I removed their brains and extracted all of the mRNA, which was then run out on a gel according to size, transferred to a membrane, and then washed in the probe for either the truncated or canonical receptor and developed. When mRNA for the truncated VT receptor was present, the probe truncated VT probe bound to that band on the membrane. Through the northern blots, we found results that led us to become confident that the truncated receptor is expressed in goldfish.
Figure

Truncated probe  Canonical probe

Figure 1. Northern blot showing a ladder for size reference (far left) and RNA treated with the probe for the truncated vasotocin receptor from control tissue (center line) and experimental tissue (mating behavior observed) (far right). The probe has bound specifically to something in the 4, 2, 1 kb regions. The canonical receptor should be at 2 kb, truncated at 1 kb. The probe has bound specifically to something in the 4 kb region, and 1.5 kb region, which could be another version of the truncated receptor. The canonical probe did not bind to any material in the tissue.

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References


