Abstract: In the study of gene regulatory networks, more and more quantitative data becomes available. However, few of the players in such networks are observed, others are latent. Focusing on the inference of multiple such latent causes, we arrive at a blind source separation problem. Under the assumptions of independent sources and Gaussian noise, this condenses to a Bayesian independent component analysis problem with a natural dynamic structure. We here present a method for the inference in networks with linear dynamics, with a straightforward extension to the nonlinear case. The proposed method uses a maximum a posteriori estimate of the latent causes, with additional prior information guaranteeing independence. We illustrate the feasibility of our method on a toy example and compare the results with standard approaches.