Recursion Schemes

folds (tear down a structure)
algebra f a → Fix f → a

↔

unfolds (build up a structure)
coalgebra f a → a → Fix f

generalized (f w ⇝ w f) → (f (w α) → β)	**cata**morphism f a → a	**ana**morphism a → f a	**g**eneralized (m f ⇝ f m) → (α → f (m β))
	prepromorphism* … after applying a NatTrans (f a → a) → (f ⇝ f)	**postpro**morphism* … before applying a NatTrans (a → f a) → (f ⇝ f)	
	paramorphism* … with primitive recursion f (Fix f × a) → a	**apo**morphism* … returning a branch or single level a → f (Fix f ∨ a)	
	zygomorphism* … with a helper function (f b → b) → (f (b × a) → a)	**g apo**morphism (b → f b) → (a → f (b ∨ a))	
g histomorphism (f h ⇝ h f) → (f (w a) → a)	**histo**morphism … with prev. answers it has given f (w a) → a	**futu**morphism … multiple levels at a time a → f (m a)	**g futu**morphism (h f ⇝ f h) → (a → f (m a))

refolds (build up then tear down a structure)
algebra g b → (f ⇝ g) → *coalgebra f a* → a → b

	hylomorphism cata; ana	
dynamorphism histo; ana	**codyna**morphism cata; futu	**g**eneralized apply the generalizations for both the relevant fold and unfold
	chronomorphism histo; futu	
Elgot algebra … may short-circuit while building cata; a → b ∨ f a	**coElgot** algebra … may short-circuit while tearing a × g b → b; ana	

others

- **synchro**morphism — ???
- **exo**morphism — ???
- **mutu**morphism — ???

reunfolds (tear down then build up a structure)
coalgebra g b → (a → b) → *algebra f a* → Fix f → Fix g

metamorphism ana; cata	**g**eneralized apply … both … [un]fold

combinations (combine two structures)
algebra f a → Fix f → Fix f → a

- **zippa**morphism — f a → a
- **merga**morphism — … which may fail to combine — (f (Fix f) × f (Fix f)) ∨ f a → a

Stolen from Edward Kmett's http://comonad.com/reader/2009/recursion-schemes/

* This gives rise to a family of related recursion schemes, modeled in recursion-schemes with distributive law combinators

These can be combined in various ways. For example, a "zygohistomorphic prepromorphism" combines the zygo, histo, and prepro aspects into a signature like *(f b → b) → (f ⇝ f) → (f (w (b × a)) → a) → Fix f → a*