

Additional File 1: Mesodermal expression and function of investigated genes in other bilaterian taxa.

Bilateria

Protostomia
Deuterostomia

Spiralia
Ecdysozoa
Ambulacraria
Chordata

Panmesodermal in radial gastrula	Gene name	<i>Terebratalia</i>	Annelids	Mollusks	Platyhelminthes	Arthropods	Nematodes	Echinoderms	Hemichordates	Cephalochordates	Tunicates	Vertebrates	Acoels
	<i>twist</i>	Pan-mesodermal in gastrula stages Anterior and chaetal sac mesoderm in larval stages!	Larval mesoderm [1]	Ectomesoderm [2]	Pharyngeal muscles, parenchyma [3]	Mesoderm specification [4, 5] Myogenesis [6]	Postembryonic mesoderm [7]	Primary mesenchyme cell ingression, larval skeleton, larval muscles [8]	?	Notochord, somites, anterior mesoderm [9]	Larval mesenchyme [10, 11] Juvenile mesoderm [11]	Head mesenchyme, limb bud mesenchyme, somites [12] Inhibition of myogenesis [13-15]	Muscles, gonads, neoblasts [16]
	<i>GATA456</i>	Pan-mesodermal in radial gastrula Pedicle and chaetal sac mesoderm in larval stages (Endoderm)!	Laval trunk mesoderm [17-19] (Endoderm [18, 19])	?	Parenchyma (Endoderm) [20]	Cardiogenesis [21]	Endomesoderm [22]	Coelomic pouches [23, 24]	?	?	(Ectoderm) [25]	Cardiogenesis [26, 27] (Endoderm) [26, 27]	Muscles, gonads, neoblasts [16]
	<i>dachshund</i>	Pan-mesodermal in gastrula stages Broadly mesodermal in larval stages (Eyes, neural, ectoderm)	Posterior mesoderm (Neural) [28]	?	(Neural) [29]	(Eyes Neural Appendages) [30-34]	(Neural) [35]	?	(Neural) [36]	Paraxial mesoderm, somites (neural) [37]	Mesenchyme (Neural) [38]	Mesenchyme, somites (eye, neural) [39, 40]	?
	<i>mPrx</i>	Pan-mesodermal in radial gastrula Pedicle/mantle mesoderm in larval stages	?	?	?	?	?	?	Gastrula and postgastrula mesoderm [41]	?	?	Craniofacial and limb bud mesenchyme, somites, cranial skeletogenesis [42-46]	?
	<i>NK1</i>	Pan-mesodermal in radial gastrula Pedicle mesoderm in larval stages (Ventral ectoderm)	Larval trunk mesoderm [47]	?	?	Myogenesis [48]	(Ectoderm) [49]	(Ectoderm) [50]	?	?	?	(Neural) [51-53]	?

Notes: Data on gene expression patterns in mesoderm are presented in BLACK. Data on gene function in mesoderm are presented in RED. Where relevant, or where no mesodermal expression is reported in the literature, data on gene expression and/or function are presented in parentheses. Where no data are available on the expression of a gene ortholog in a given taxon, a question mark is shown. Gene orthology groups are organized by timing or location of first detected mesodermal expression in *Terebratalia* (shown at left).

Additional File 1 continued: Mesodermal expression and function of investigated genes in other bilaterian taxa.

Bilateria

Protostomia
Deuterostomia

Spiralia
Ecdysozoa
Ambulacraria
Chordata

Gene name	<i>Terebratalia</i>	Annelids	Mollusks	Platyhelminthes	Arthropods	Nematodes	Echinoderms	Hemichordates	Cephalochordates	Tunicates	Vertebrates	Acoels
<i>Pax1/9</i>	Lateral and posterior mesoderm in gastrula stages Mantle and pedicle ventral mesoderm in larval stages	?	?	?	Body wall muscles [54]	?	?	(Pharyngeal endoderm) [55-57]	(Pharyngeal endoderm) [58]	(Pharyngeal endoderm) [55]	Sclerotome, vertebral column [59-61] (Pharyngeal endoderm) [62]	?
<i>MyoD</i>	Posterior mesoderm in radial gastrula Apical, mantle, and pedicle mesoderm in larval stages	?	?	?	Myogenesis [63]	Mesoderm fate specification, myogenesis [64]	Skeletogenic mesoderm, larval musculature [65]	?	Paraxial mesoderm, somatic myotomes [66]	Myogenesis [67]	Myogenesis [68]	?
<i>Six1/2</i>	Anterior mesoderm in radial gastrula Apical, mantle, and pedicle mesoderm in larval stages (Ectoderm)	(Eyes) [69]	?	(Eyes) [29]	(Eyes) [70]	Non-muscle mesoderm [71]	Coelomic mesoderm [65]	Gastrula and postgastrula mesoderm [41]	Invaginating endomesoderm somites [72]	(Ectoderm, endoderm) [38]	Somites, myoblast precursors, mesenchyme [73] Myogenesis [74, 75] Cranial skeletogenesis [76] Kidney development [77]	Muscles, gonads, neoblasts [16]
<i>FoxC</i>	Anterior mesoderm in gastrula stages Apical and ventral pedicle mesoderm in larval stages (Ectoderm)	Anterior mesoderm, posterior trunk mesoderm [78]	Anterior mesoderm, posttrochal mesoderm [78]	?	Anterior and posterior mesoderm [79]	No ortholog	Myoblasts, mesenchyme [65, 80]	Gastrula and postgastrula mesoderm [81]	Invaginating endomesoderm [82]	(Neural) [83]	Paraxial mesoderm, cardiogenesis [84-86]	Muscles, gonads, parenchyma, neoblasts [16]

Localized mesodermal in radial gastrula

Additional File 1 continued: Mesodermal expression and function of investigated genes in other bilaterian taxa.

The phylogenetic tree shows Bilateria branching into Protostomia and Deuterostomia. Protostomia includes Spiralia and Ecdysozoa. Deuterostomia includes Ambulacraria and Chordata. Chordata includes Cephalochordates, Tunicates, Vertebrates, and Acoels.

	Gene name	<i>Terebratalia</i>	Annelids	Mollusks	Platyhelminthes	Arthropods	Nematodes	Echinoderms	Hemichordates	Cephalochordates	Tunicates	Vertebrates	Acoels
Asymmetric gastrula	<i>Eya</i>	Pan-mesodermal in asymmetric gastrula Apical and pedicle mesoderm in larval stages (Ectoderm)	?	Light organ (Eyes, neural, tentacles, mantle, gills) [87]	(Eyes, neural) [29]	Myogenesis [88]	Anterior morphogenesis pharynx differentiation, gonad and vulva formation [89]	Non-skeletogenic mesoderm, coelomic mesoderm [50, 90]	(Ectoderm, pharyngeal endoderm) [57]	Invaginating endomesoderm, posterior somites, notochord [72]	Mesenchyme, trunk lateral cells [38]	Myogenesis [91] Kidney development [92]	?
	<i>FoxF</i>	Anterior mesoderm in asymmetric gastrula Apical and pedicle mesoderm in larval stages	Anterior mesoderm, posterior trunk mesoderm [78]	Anterior mesoderm, posttrochal mesoderm [78]	?	Visceral mesoderm [93]	Coelomocytes [94]	Non-skeletogenic mesoderm, myoblasts, [65, 80]	Gastrula and postgastrula mesoderm, heart/kidney, visceral mesoderm [81]	Ventral mesoderm [82]	Cardiogenesis [95]	Extra-embryonic mesoderm, lateral plate mesoderm [96] Splanchnic mesoderm [97, 98]	?
	<i>Mox</i>	Apical/mantle and pedicle mesoderm in larval stages	Ventral mesoderm [99]	Ventral mesoderm [100]	?	Dorsal median cells 101	No ortholog	(Neural) [102]	Ventral mesoderm [103]	Presomitic mesoderm [104]	Muscle [83]	Somitogenesis, limb musculature [105, 106]	?
Larva	<i>Paraxis</i>	Apical/mantle and pedicle mesoderm in larval stages	Ventrolateral mesoderm [99]	?	?	(Neural) [107]	No ortholog	?	?	Posterior paraxial mesoderm [108]	?	Mesoderm formation, somitogenesis, chondrogenesis, musculoskeletal patterning [109, 110]	?

Additional File 1 continued: Mesodermal expression and function of investigated genes in other bilaterian taxa.

The phylogenetic tree shows Bilateria branching into Protostomia and Deuterostomia. Protostomia includes Spiralia and Ecdysozoa. Deuterostomia includes Ambulacraria and Chordata. The table below details the expression and function of genes in various taxa across these groups.

		Bilateria											
		Protostomia						Deuterostomia					
		Spiralia		Ecdysozoa				Ambulacraria		Chordata			
		<i>Terebratalia</i>	Annelids	Mollusks	Platyhelminthes	Arthropods	Nematodes	Echinoderms	Hemichordates	Cephalochordates	Tunicates	Vertebrates	Acoels
Larva	<i>Limpet</i> (FHL genes for vertebrates)	Apical and mantle mesoderm in early larva Broadly mesodermal in late larval (Ectoderm)	?	?	?	Visceral mesoderm [111]	Body wall muscle [112, 113]	?	?	?	?	Heart, somites, muscle [114-116]	?
	<i>Mef2</i>	Apical and mantle mesoderm in early larva Broadly mesodermal in late larval	?	?	?	Myogenesis [117, 118]	Ubiquitous (not essential for myogenesis or development) [119]	Coelomic mesoderm, primary mesenchyme cells [65]	?	?	Muscle [83]	Myogenesis, cardiogenesis, chondrogenesis, neural crest [120-122]	Muscles, gonads, neoblasts [16]
Outside archenteron wall	<i>FoxD</i>	Posterior archenteron wall/roof in gastrula stages Ventral mesoderm in larval stages (Ectoderm)	Ventral mesoderm [99]	?	?	(Neural) [123]	Ventral muscle Distal tip cell migration, axonal guidance [124]	(Ectoderm, endoderm) [50, 80]	Ventrolateral mesoderm [81]	Axial mesoderm, paraxial mesoderm, notochord, somites [125]	(Endoderm) Notochord induction [126]	Somites, notochord, mesenchyme [127-129]	?
	<i>noggin</i>	Blastopore lip in gastrula stages Ventral mesoderm in larval stages (Ectoderm)	Ventral mesoderm [99]	?	?	No ortholog	No ortholog	?	?	?	?	Notochord Somite differentiation, neural tube formation [130-132]	?

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