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The Role of the Ets Domain Transcription Factor Erm in Modulating Differentiation of Neural Crest Stem Cells

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Abstract

The transcription factor Erm is a member of the Pea3 subfamily of Ets domain proteins that is expressed in multipotent neural crest cells, peripheral neurons, and satellite glia. A specific role of Erm during development has not yet been established. We addressed the function of Erm in neural crest development by forced expression of a dominant-negative form of Erm. Functional inhibition of Erm in neural crest cells interfered with neuronal fate decision, while progenitor survival and proliferation were not affected. In contrast, blocking Erm function in neural crest stem cells did not influence their ability to adopt a glial fate, independent of the glia-inducing signal. Furthermore, glial survival and differentiation were normal. However, the proliferation rate was drastically diminished in glial cells, suggesting a glia-specific role of Erm in controlling cell cycle progression. Thus, in contrast to other members of the Pea3 subfamily that are involved in late steps of neurogenesis, Erm appears to be required in early neural crest development. Moreover, our data point to multiple, lineage-specific roles of Erm in neural crest stem cells and their derivatives, suggesting that Erm function is dependent on the cell intrinsic and extrinsic context.

Keywords

PNS; neural crest stem cells; glia; proliferation; neuronal fate; Erm; Ets domain transcription factor

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References

REFERENCES

1 C. Albanese, J. Johnson, G. Watanabe, N. Eklund, D. Vu, A. Arnold, R.G. Pestell
Transforming p21ras mutants and c-Ets-2 activate the cyclin D1 promoter through distinguishable regions
J. Biol. Chem., 270 (1995), pp. 23589-23597

2 D.J. Anderson
Lineages and transcription factors in the specification of vertebrate primary sensory neurons
Curr. Opin. Neurobiol., 9 (1999), pp. 517-524
Article PDF (1MB)

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3 D.J. Anderson, A. Groves, L. Lo, Q. Ma, M. Rao, N.M. Shah, L. Sommer
Cell lineage determination and the control of neuronal identity in the neural crest
Cold Spring Harbor Symp. Quant. Biol., 62 (1997), pp. 493-504

4 S. Arber, D.R. Ladle, J.H. Lin, E. Frank, T.M. Jessell
ETS gene Er81 controls the formation of functional connections between group Ia sensory afferents and motor neurons
Cell, 101 (2000), pp. 485-498
Article PDF (1016KB)

5 J.F. Brunet, A. Ghysen
Deconstructing cell determination: Proneural genes and neuronal identity
Bioessays, 21 (1999), pp. 313-318

6 A. Chotteau-Lelièvre, X Desbiens, H. Pelczar, P.-A. Defossez, Y. de Lanoit
Differential expression patterns of the PEA3 group transcription factors through murine embryonic development
Oncogene, 15 (1997), pp. 937-952

7 H.C. Crawford, B. Fingleton, M.D. Gustavson, N. Kurpios, R.A. Wagenaar, J.A. Hassell, L.M. Matrisian
The PEA3 subfamily of Ets transcription factors synergizes with beta- catenin-LEF-1 to activate matrilysin transcription in intestinal tumors
Mol. Cell. Biol., 21 (2001), pp. 1370-1383

8 W. Dang, X.H. Sun, R. Sen
ETS-mediated cooperation between basic helix–loop–helix motifs of the immunoglobulin mu heavy-chain gene enhancer
Mol. Cell. Biol., 18 (1998), pp. 1477-1488

9 P.A. Defossez, J.L. Baert, M. Monnot, Y. de Launoit
The ETS family member ERM contains an alpha-helical acidic activation domain that contacts TAFII60
Nucleic Acids Res., 25 (1997), pp. 4455-4463

10 R.P. DeKoter, H. Singh
Regulation of B lymphocyte and macrophage development by graded expression of PU. 1
Science, 288 (2000), pp. 1439-1441

11 R.P. DeKoter, J.C. Walsh, H. Singh
PU. 1 regulates both cytokine-dependent proliferation and differentiation of granulocyte/macrophage progenitors
EMBO J., 17 (1998), pp. 4456-4468

12 J. Dittmer, A. Nordheim
Ets transcription factors and human disease
Biochim. Biophys. Acta, 1377 (1998), pp. F1-F11
Article PDF (253KB)

13 A. Greenall, N. Willingham, E. Cheung, D.S. Boam, A.D. Sharrocks
DNA binding by the ETS-domain transcription factor PEA3 is regulated by intramolecular and intermolecular protein. protein interactions
J. Biol. Chem., 276 (2001), pp. 16207-16215

14 L. Hagedorn, C. Paratore, G. Brugnoli, J.L. Baert, N. Mercader, U. Suter, L. Sommer
The Ets domain transcription factor Erm distinguishes rat satellite glia from Schwann cells and is regulated in satellite cells by neuregulin signaling
Dev. Biol., 219 (2000), pp. 44-58
Article PDF (860KB)

15 L. Hagedorn, U. Suter, L. Sommer
P0 and PMP22 mark a multipotent neural crest-derived cell type that displays community effects in response to TGF-β family factors
Development, 126 (1999), pp. 3781-3794

16 K. Han, J.L. Manley
Functional domains of the Drosophila Engrailed protein
EMBO J., 12 (1993), pp. 2723-2733

17 L.R. Howe, H.C. Crawford, K. Subbaramaiah, J.A. Hassell, A.J. Dannenberg, A.M. Brown
PEA3 is up-regulated in response to Wnt1 and activates the expression of cyclooxygenase-2
J. Biol. Chem., 276 (2001), pp. 20108-20115

18 M. Iwamoto, Y. Higuchi, E. Koyama, M. Enomoto-Iwamoto, K. Kurisu, H. Yeh, W.R. Abrams, J. Rosenbloom, M. Pacifici
Transcription factor ERG variants and functional diversification of chondrocytes during limb long bone development
J. Cell Biol., 150 (2000), pp. 27-40

19 R. Janknecht, D. Monte, J.L. Baert, Y. de Launoit
The ETS-related transcription factor ERM is a nuclear target of signaling cascades involving MAPK and PKA
Oncogene, 13 (1996), pp. 1745-1754

20 M.P. Laget, P.A. Defossez, O. Albagli, J.L. Baert, F. Dewitte, D. Stehelin, Y. de Launoit
Two functionally distinct domains responsible for transactivation by the Ets family member ERM
Oncogene, 12 (1996), pp. 1325-1336

21 M.A. Laing, S. Coonrod, B.T. Hinton, J.W. Downie, R. Tozer, M.A. Rudnicki, J.A. Hassell
Male sexual dysfunction in mice bearing targeted mutant alleles of the PEA3 ets gene
Mol. Cell. Biol., 20 (2000), pp. 9337-9345

22 S.J. Langer, D.M. Bortner, M.F. Roussel, C.J. Sherr, M.C. Ostrowski
Mitogenic signaling by colony-stimulating factor 1 and ras is suppressed by the ets-2 DNA-binding domain and restored by myc overexpression
Mol. Cell. Biol., 12 (1992), pp. 5355-5362

23 J. Lee
Basic helix–loop–helix genes in neural development
Curr. Opin. Neurobiol., 7 (1997), pp. 13-20
Article PDF (922KB)

24 R. Li, H. Pei, D.K. Watson
Regulation of Ets function by protein–protein interactions
Oncogene, 19 (2000), pp. 6514-6523

25 J.H. Lin, T. Saito, D.J. Anderson, C. Lance-Jones, T.M. Jessell, S. Arber
Functionally related motor neuron pool and muscle sensory afferent subtypes defined by coordinate ETS gene expression
Cell, 95 (1998), pp. 393-407
Article PDF (1MB)

26 L. Lo, L. Sommer, D.J. Anderson
MASH1 maintains competence for BMP2-induced neuronal differentiation in post-migratory neural crest cells
Curr. Biol., 7 (1997), pp. 440-450
Article PDF (691KB)

27 S.M. Maira, J.M. Wurtz, B. Wasylyk
Net (ERP/SAP2) one of the Ras-inducible TCFs, has a novel inhibitory domain with resemblance to the helix–loop–helix motif
EMBO J., 15 (1996), pp. 5849-5865

28 D. Monté, J.-L. Baert, P.-A. Defossez, Y. de Lanoit, D. Stéhelin
Molecular cloning and characterization of human ERM, a new member of the Ets family closely related to mouse PEA3 and ER81 transcription factors
Oncogene, 9 (1994), pp. 1397-1406

29 S.J. Morrison, S.E. Perez, Z. Qiao, J.M. Verdi, C. Hicks, G. Weinmaster, D.J. Anderson
Transient Notch activation initiates an irreversible switch from neurogenesis to gliogenesis by neural crest stem cells
Cell, 101 (2000), pp. 499-510
Article PDF (262KB)

30 C. Paratore, D.E. Goerich, U. Suter, M. Wegner, L. Sommer
Survival and glial fate acquisition of neural crest cells are regulated by an interplay between the transcription factor Sox10 and extrinsic combinatorial signaling
Development, 128 (2001), pp. 3949-3961

31 C. Paratore, U. Suter, L. Sommer
Embryonic gene expression resolved at the cellular level by fluorescence in situ hybridization
Histochem. Cell Biol., 111 (1999), pp. 435-443

32 R. Pereira, C.T. Quang, I. Lesault, H. Dolznig, H. Beug, J. Ghysdael
FLI-1 inhibits differentiation and induces proliferation of primary erythroblasts
Oncogene, 18 (1999), pp. 1597-1608

33 P. Remy, M. Baltzinger
The Ets-transcription factor family in embryonic development: Lessons from the amphibian and bird
Oncogene, 19 (2000), pp. 6417-6431

34 R.R. Rivera, M.H. Stuiver, R. Steenbergen, C. Murre
Ets proteins: New factors that regulate immunoglobulin heavy-chain gene expression
Mol. Cell Biol., 13 (1993), pp. 7163-7169

35 E.W. Scott, M.C. Simon, J. Anastasi, H. Singh
Requirement of transcription factor PU. 1 in the development of multiple hematopoietic lineages
Science, 265 (1994), pp. 1573-1577

36 N. Shah, A. Groves, D.J. Anderson
Alternative neural crest cell fates are instructively promoted by TGFβ superfamily members
Cell, 85 (1996), pp. 331-343
Article PDF (485KB)

37 N.M. Shah, M.A. Marchionni, I. Isaacs, P. Stroobant, D.J. Anderson
Glial growth factor restricts mammalian neural crest stem cells to a glial fate
Cell, 77 (1994), pp. 349-360
Article PDF (7MB)

38 A.D. Sharrocks
The ets-domain transcription factor family
Nat. Rev. Mol. Cell Biol., 2 (2001), pp. 827-837

39 T.G. Shepherd, L. Kockeritz, M.R. Szrajber, W.J. Muller, J.A. Hassell
The pea3 subfamily ets genes are required for HER2/Neu-mediated mammary oncogenesis
Curr. Biol., 11 (2001), pp. 1739-1748
Article PDF (584KB)

40 M.H. Sieweke, H. Tekotte, U. Jarosch, T. Graf
Cooperative interaction of ets-1 with USF-1 required for HIV-1 enhancer activity in T cells
EMBO J., 17 (1998), pp. 1728-1739

41 L. Sommer
Context-dependent regulation of fate decisions in multipotent progenitor cells of the peripheral nervous system
Cell Tissue Res., 305 (2001), pp. 211-216

42 L.M. Spain, A. Guerriero, S. Kunjibettu, E.W. Scott
T cell development in PU.1-deficient mice
J. Immunol., 163 (1999), pp. 2681-2687

43 D.L. Stemple, D.J. Anderson
Isolation of a stem cell for neurons and glia from the mammalian neural crest
Cell, 71 (1992), pp. 973-985
Article PDF (7MB)

44 A. Tamir, J. Howard, R.R. Higgins, Y.J. Li, L. Berger, E. Zacksenhaus, M. Reis, Y. Ben-David
Fli-1, an Ets-related transcription factor, regulates erythropoietin-induced erythroid proliferation and differentiation: Evidence for direct transcriptional repression of the Rb gene during differentiation
Mol. Cell. Biol., 19 (1999), pp. 4452-4464

45 J.M. Taylor, E.E. Dupont-Versteegden, J.D. Davies, J.A. Hassell, J.D. Houlé, C.M. Gurley, C.A. Peterson
A role for the ETS domain transcription factor PEA3 in myogenic differentiation

Mol. Cell. Biol., 17 (1997), pp. 5550-5558

46 G. Tian, B. Erman, H. Ishii, S.S. Gangopadhyay, R. Sen
Transcriptional activation by ETS and leucine zipper-containing basic helix–loop–helix proteins
Mol. Cell. Biol., 19 (1999), pp. 2946-2957

47 B. Wasylyk, J. Hagman, A. Gutierrez-Hartmann
Ets transcription factors: Nuclear effectors of the Ras-MAP-kinase signaling pathway
Trends Biochem. Sci., 23 (1998), pp. 213-216
Article PDF (108KB)

48 C. Wasylyk, S.M. Maira, P. Sobieszczuk, B. Wasylyk
Reversion of Ras transformed cells by Ets transdominant mutants
Oncogene, 9 (1994), pp. 3665-3673

49 S.C. Wen, D.H. Ku, A. De Luca, P.P. Claudio, A. Giordano, B. Calabretta
ets-2 regulates cdc2 kinase activity in mammalian cells: Coordinated expression of cdc2 and cyclin A
Exp. Cell Res., 217 (1995), pp. 8-14
Article PDF (568KB)

50 P.R. Yates, G.T. Atherton, R.W. Deed, J.D. Norton, A.D. Sharrocks
Id helix–loop–helix proteins inhibit nucleoprotein complex formation by the TCF ETS-domain transcription factors
EMBO J., 18 (1999), pp. 968-976

51 J.S. Yordy, R.C. Muise-Helmericks
Signal transduction and the Ets family of transcription factors
Oncogene, 19 (2000), pp. 6503-6513

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