結論

モルモットの内耳で発見されたカルシウム結合性蛋白質CBP-15はそのアミノ酸配列からparvalbuminのサブタイプであるOMと考えられ、モノクローナル抗体および質重量分析によりこれを確認した。

OMの検出は哺乳類の正常組織においては初めてのことであり、モルモットのほかラット、マウスのコルチ器にも存在していた。モルモットにおいては、外有毛細胞に特異的に存在していたことから、OMが外有毛細胞内のカルシウム制御を介して、哺乳類の聴覚における優れた周波数弁別に重要な役割を果たしているものと考えられた。

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文献

1）Spoendlin H : Innervation patterns in the organ of Corti of the cat. Acta Otolaryngol (Stockh) 67 : 239-254, 1969.

2）Brownell WE, Bader CR, Bertrand D : Evoked mechanical responses of isolated cochlear outer hair cells. Science 227 : 194-196, 1985.

3）Kalinec F, Holley MC, Iwasa KH, Lim DJ,

Kacher B : A membrane-based force generation mechanism in auditory sensory cells. Proc Natl Acad Sci USA 89 : 8671-8675, 1992.
4) Mountain DC : Electromechanical properties of hair cells. Neurobiology of Hearing : The Cochlea, Raven Press, New York, 77-90, 1986
5) Zenner HP, Zimmermann U, Schmitt U : Reversible contraction of isolated mammalian cochlear hair cells. Hear Res 18 : 127-133, 1985.
6) Santos-Sacchi J : Asymmetry in voltage-dependent movements of isolated outer hair cells from the organ of Corti. J Neuroscience 9 : 2954-2962, 1989.
7) Dulon D, et al : Motility of cochlear outer hair cells. Am J Otol 13 : 108-112, 1992.
8) Kemp DT : Stimulated acoustic emissions from within the human auditory system. J Acoust Soc Am 64 : 1386-1391, 1978.
9) Hinz M, Wedel H von : Otoakustische Emissonen bei Patienten mit Horsturz. Arch Oto-Rhino-Laryngol(Suppl II) : 128-130, 1984.
10) Tanaka Y, Suzuki M, Inoue T : Evoked otoacoustic emissions in sensorineural hearing impairment. Ear Hear 11 : 134-143, 1990.
11) Mountain DC : Changes in endolymphatic potential and crossed olivo-cochlear bundle stimulation alter cochlear mechanics. Science 210 : 71-72, 1980.

1 2) Siegel JH, Kim DO : Efferent neural control of cochlear mechanics? Hear Res 6 : 171-182, 1982.
1 3) Slepecky NB, Ulfendahl M : Evidence for calcium-binding proteins and calcium-dependent regulatory proteins in sensory cells of the organ of Corti. Hear Res 70 : 73-84, 1993.
1 4) 高橋邦明、原　晃、草刈　潤、Thalmann I、Thalmann R : コルチ器におけるCalmodulinの定量. Ear Research Japan 20(2) : 43-49, 1989.
1 5) Oberholtzer JC, Buettger C, Matschinsky FM et al. : The 28-kDa calbindin-D is a major calcium-binding protein in the basilar papilla of the chick. Proc Natl Acad Sci USA 85 : 3387-3390, 1988.
1 6) Senarita M, Thalmann I, Shibasaki O, Thalmann R : Calcium-binding proteins in the organ of Corti and basilar papilla. : CBP-15, an unidentified calcium-binding ptotein of the inner ear. Hear Res 90 : 169-175, 1995.
1 7) Thalmann I, Suzuki H, McCourt DW, Comegys TH, Thalmann R : Partial amino acid sequence of organ of Corti proteins OCP1 and OCP2 : a progress report. Hear Res 64 : 191-198, 1993.
1 8) Senarita M, Thalmann I, Thalmann R : Evidence against a calcium-binding function of OCP2. Abstract, 17th Midwinter Meeting ARO, St. Petersburg, FL, p. 138, 1994.
1 9) Thalmann I, Shibasaki O, Thalmann R et al.: Detection of a beta-parvalbumin isoform

in the mammalian inner ear. Biochem Biophys Res Commun 215 : 142-147, 1995.
20) Shibasaki O, Thalmann I, Comegys TH, Senarita M, Thalmann R : Organ of Corti preferentially expresses an isoform of beta-parvalbumin, a subfamily previously considered absent in mammalian tissue. Abstract, 19th Midwinter Meeting ARO, St. Petersburg, FL, p. 152, 1996.
21) Henzl MT, Shibasaki O, Thalmann I et al. : Oncomodulin is abundant in the organ of Corti. Hear Res 106 : 105-111, 1997.
22) 柴崎 修、瀬成田雅光、原 晃、草刈 潤、Isolde Thalmann、Ruediger Thalmann : 哺乳類蝸牛におけるoncomodulinの検出およびその局在について. Otol Jpn 8(3) : 159-164, 1998.
23) Thalmann R, Thalmann I, Comegys TH : Dissection and chemical analysis of substructures of the organ of Corti. Laryngoscope 80 : 1619-1645, 1970.
24) Oakley BR, Kirsch DR and Morris NR : A simplified ultrasensitive silver stain for detecting proteins in polyacrylamide gels. Ann Clin Biochem 105 : 361-363, 1980.
25) Towbin H, Staehelin T and Gordon J : Electrophoretic transfer of proteins from polyacrylamide gels to nitrocellulose sheets: procedures and some applications. Proc Natl Sci USA 76 : 4350-4353, 1979.
26) Hirano H, Komatsu S, Tsunasawa S et al. : Microsequence analysis of the N-terminally blocked proteins immobilized on polyviny-

lidene difluoride membrane by western blotting. Electrophoresis14 : 839-846, 1993.
27) Thalmann I, Suzuki H, Thalmann R et al. : Partial amino acid sequence of organ of Corti protein OCP-II. Eur Arch Otorhinolaryngol 248 :15-18, 1990.
28) Patterson SD, Hess D, Yungwirth T and Aebersold R : High-Yield Recovery of Electroblotted Proteins and Cleavage Fragments from a Cationic Polyvinylidene Fluoride-Based Membrane. Analytical Biochemistry 202 :193-203, 1992.
29) MacManus JP : Development and use of a quantitative immunoassay for the calcium-binding protein (molecular weight, 11,500) of Morris hepatoma 5123. Cancer Res 41 : 974-979, 1981.
30) Huber S, Leuthold M, Heizmann, CW et al. : Human tumor cell lines express low levels of oncomodulin. Biochem Biophys Res Commun 169 : 905-909, 1990.
31) 小島 至：カルシウムと細胞情報 羊土社, 東京, 1992.
32) Celio MR, Heizmann CW : Calcium-binding protein parvalbumin as a neuronal marker. Nature 293 : 300-302, 1981.
33) Eybalin M, Ripoll C : Immunolocalisation of parvalbumin in two glutamatergic cell types of the guinea pig cochlea. C. R. Acad. Sci. Paris, t.310, Serie III : 639-644, 1990.
34) MacManus JP, Watson DC, Yaguchi M : The complete amino acid sequence of

oncomodulin-a parvalbumin-like calcium-binding protein from Morris hepatoma 5123tc. Eur J Biochem 136 : 9-17, 1983.
35) Hapak RC, Zhao H, Henzl MT et al. : Novel avian thymic parvalbumin displays high degree of sequence homology to oncomodulin. J Biological Chemistry 269 : 5288-5296, 1994.
36) Fohr UG, Weber BR, Muntener M, Staudenmann W, Hughes GJ, Frutiger S, Banville D, Schafer BW and Heizmann CW : Human alpha and beta parvalbumins. Eur J Biochem 215 : 719-727, 1993.
37) MacManus JP : Occurrence of a low-molecular-weight calcium-binding protein in neoplastic liver. Cancer Res 39 : 3000-3005, 1979.
38) Brewer LM, MacManus JP : Detection of oncomodulin, an oncodevelopmental protein in human placenta and choriocarcinoma cell lines. Placenta 8 : 351-363, 1986.
39) Boynton AL, MacManus JP, Whitfield JF : Stimulation of liver cell DNA synthesis by oncomodulin, an MW 11,500 calcium-binding protein from hepatoma. Expt Cell Res 138 : 454-458, 1982.